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UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

LENOVO (UNITED STATES) INC. and MOTOROLA MOBILITY, LLC,

Plaintiffs,

v.

IPCOM GMBH & CO., KG,

Defendant.

Case No._____

COMPLAINT FOR:

(1) Breach of Contract;
(2) Declaratory Judgment;
(3) Antitrust Monopolization in Violation of Section 2 of the Sherman Act;
(4) Declaratory Judgment of Non-Infringement of U.S. Patent No. 6,307,844; and
(5) Declaratory Judgment of Non-Infringement of U.S. Patent No. 6,920,124.

JURY TRIAL DEMANDED

Plaintiffs Lenovo (United States) Inc. ("Lenovo") and Motorola Mobility, LLC ("Motorola," or collectively with Lenovo, "Plaintiffs") allege the following facts and claims against Defendant IPCom GmbH & Co., KG ("IPCom" or "Defendant").

INTRODUCTION

1. Plaintiffs, leading providers of wireless devices—including tablets, laptops, and mobile phones—bring this lawsuit because of IPCom's failure to offer a license to its alleged standard essential patents ("SEPs") relevant to the 2G, 3G, and 4G cellular standards to Plaintiffs on fair, reasonable, and non-discriminatory ("FRAND") terms and conditions. Plaintiffs are willing licensees and seek to pay a FRAND royalty rate for a license to the alleged SEPs owned or controlled by IPCom. Accordingly, Plaintiffs seek a declaration of their rights and IPCom's breaches of contract and other violations of law, as well as the determination and imposition of the FRAND terms and conditions for a license to the alleged SEPs owned or controlled by IPCom.

2. Many of the products provided by Plaintiffs rely on cellular connectivity. Cellular connectivity requires the use of widely adopted cellular standards—such as second generation ("2G"), third generation ("3G"), and/or fourth generation ("4G")—adopted by various standard setting organizations ("SSOs"), such as the European Telecommunications Standards Institute ("ETSI").

3. IPCom claims to own patents that have been declared essential to the cellular standards adopted by ETSI and implemented by the products Plaintiffs manufacture and sell. Having been declared as essential to these standards, the patents are encumbered, under ETSI's Intellectual Property Rights ("IPR") Policies, and thus must be licensed on FRAND terms and conditions to all potential implementers of the standards, such as Plaintiffs. SSOs relied on such FRAND commitments when they purportedly incorporated the patents now owned or controlled by IPCom into the relevant standards.

4. IPCom is a member of ETSI and has submitted at least one ETSI IPR Declaration promising to license any of its intellectual property rights related to *all* ETSI standards made by it *and/or its affiliates* on FRAND terms and conditions. Additionally, as an "Individual Member" of the 3rd Generation Partnership Project ("3GPP"), IPCom was bound by the IPR policy of ETSI, the organizational partner through which IPCom participated in 3GPP. Moreover, upon information and belief, a majority of the patents under IPCom's ownership or control were obtained from Robert Bosch GmbH ("Bosch") or Hitachi Ltd. ("Hitachi"), both of whom have submitted numerous ETSI IPR Declarations similarly promising to license their alleged SEPs on FRAND terms and conditions. As a successor-in-interest to the patents IPCom obtained from Bosch and Hitachi, IPCom is obligated under the FRAND commitments made by both Bosch and Hitachi.

5. ETSI and other SSOs require FRAND commitments in recognition of the dangers inherent in collective standard-setting activities, which eliminate competitive technological alternatives that otherwise would have existed in the market. Once standardized, a technology is "locked in" and must be practiced by all who wish to produce standard-compliant products. Such lock-in gives SEP owners the market power to exclude companies from practicing the standard, and to raise the cost of practicing the standards by charging supra-competitive royalties in excess of the *ex ante* value of such technology when it still competed with alternatives. This phenomenon is often referred to as "hold-up." Such market power does not derive from the original patenting of the SEPs at issue, but results directly from collective action. Having its proprietary technology included in the standards enables the SEP owner to license a much greater volume of products than would be the case if the technology was not used in the standards. To ameliorate the risks posed by, and as a trade-off for, this market power, the SEP owner is required to make the FRAND licensing commitment.

6. As a supplier of products implementing various cellular standards, Plaintiffs are third-party beneficiaries of the alleged SEP holder's (i.e., IPCom's) FRAND promises to ETSI. Relying on these FRAND promises, Plaintiffs invested significant resources to develop products that practice the relevant cellular standards, including in the United States and California.

7. However, after locking in the industry through the cellular standards, IPCom breached the promises made by itself and its predecessors-in-interest to ETSI by failing to offer a license to Plaintiffs on FRAND terms and conditions. Instead, upon information and belief, IPCom has demanded royalties that are discriminatory and far higher than FRAND rates. Thus, it is clear, now that the cellular standards have been approved incorporating IPCom's allegedly essential patented technology, that IPCom's promises to license its allegedly essential patents on FRAND terms and conditions were false.

8. Plaintiffs are ready and willing licensees, seeking a license to IPCom's alleged SEPs, but IPCom's royalty demands for a patent license plainly violate its FRAND commitments, including but not limited to:

- Attempting to seek supra-competitive royalty rates from Plaintiffs for a license to its 2G, 3G, and 4G patents;
- Demanding Plaintiffs pay royalties for patents that are, in fact, not essential to the ETSI standards; and
- Demanding Plaintiffs pay royalties for expired patents or patents that will expire during the course of the proposed license.

9. Further, in an attempt to coerce Plaintiffs to enter into a license that is not on FRAND terms and conditions, IPCom recently contacted at least one of Plaintiffs' customers specifically asserting that its sale of Plaintiffs' unlicensed products put it at serious legal and financial risk. IPCom initiated this contact with Plaintiffs' customer while in the middle of negotiations with Plaintiffs, knowing that this customer would never have to pay patent royalties if a FRAND license was

offered and entered into between Plaintiffs and IPCom. IPCom's primary purpose in contacting this customer was to coerce Plaintiffs into accepting the non-FRAND licensing terms being offered by IPCom at the time.

10. Plaintiffs are ready and willing licensees, as long as the terms and conditions are consistent with the FRAND promises made by IPCom and its predecessors-in-interest. Unfortunately, however, IPCom is refusing to negotiate in good faith with Plaintiffs for such a license and has, in fact, resorted to interfering with Plaintiffs' customer relationships in an attempt to get Plaintiffs' acquiescence to its unreasonable license demands.

11. As a result, Plaintiffs have no choice but to bring this lawsuit in order to address the above breaches of contracts and other violations of law, and to obtain a license on behalf of itself, and all of its worldwide affiliates who require such a license, to the SEPs owned or controlled by IPCom on FRAND terms and conditions.

THE PARTIES

A. Lenovo and Motorola

12. Plaintiff Lenovo (United States) Inc. ("Lenovo") is a corporation organized under the laws of the State of Delaware, with its principal place of business at 8001 Development Dr., Morrisville, NC 27560.

13. Plaintiff Motorola Mobility, LLC ("Motorola") is an affiliate of Lenovo (United States) Inc. Motorola Mobility, LLC is a corporation organized under the laws of the State of Delaware, with its principal place of business at 222 W. Merchandise Mart Plaza, Chicago, IL 60654. In 2014, Lenovo's parent, Lenovo Group Limited, acquired Motorola. Lenovo's Chief Executive Officer, Yang Yuanqing, explained at the time that "the acquisition of such an iconic brand . . . will immediately make Lenovo a strong global competitor in smartphones." Lenovo and Motorola continue to develop and market personal computers, wireless devices,

and smart devices worldwide, such products combined account for 86% of Lenovo and Motorola's total revenue in financial year 2017/18.

14. Plaintiffs' large portfolio of products are capable of incorporating a wide variety of cellular technologies. Supported cellular technologies include 2G, 3G, and 4G standards. These cellular technologies offer different levels of performance and cost benefits.

B. IPCom

15. Upon information and belief, Defendant IPCom GmbH & Co., KG ("IPCom" or "Defendant") is a company organized and existing under the laws of Germany, with its principal place of business at Zugspitzstraße 15, Pullach, Germany 82049.

16. Upon information and belief, IPCom derives its revenue almost exclusively from its patent licensing business, regularly conducting such business in the United States. For example, IPCom has engaged in patent license negotiations with Plaintiffs in the United States, which includes a license to a multitude of United States patents.

17. Upon information and belief, in 2007 IPCom acquired a patent portfolio from Bosch, which included approximately 160 patent families comprising about 1,000 individual patents. In or about 2013, IPCom acquired a portfolio of patents from Hitachi, which included approximately 17 patent families comprising about 135 individual patents purportedly covering aspects of the 3G cellular standards. With its acquisition of the Hitachi portfolio of patents, IPCom began focusing on the US market for additional licensing opportunities.

18. Upon information and belief, IPCom is partnered with United States company Karols Development Co LLC ("Karols Development") in a pledge agreement regarding patents under IPCom's ownership or control. Karols Development is a company organized under the laws of Delaware with its principal

place of business at 1345 Avenue of the Americas, 46th Floor, New York, NY 10105.

19. IPCom has used threats of litigation in the United States in its attempts to coerce at least Plaintiffs into licensing IPCom's alleged SEPs on non-FRAND terms and conditions.

JURISDICTION AND VENUE

20. Plaintiffs bring this action for specific performance, declaratory relief, injunctive relief, costs of suit, and reasonable attorneys' fees arising under, *inter alia*, the patent laws of the United States, 35 U.S.C. § 1 *et seq.*; Section 2 of the Sherman Act and Section 16 of the Clayton Act, 15 U.S.C. §§ 1, 2, 26; and the Declaratory Judgment Act, 28 U.S.C. §§ 2201 and 2202. Accordingly, this Court has jurisdiction to hear this case pursuant to 28 U.S.C. §§ 1331, 1337, and Section 4 of the Clayton Act, 15 U.S.C. § 15. Additionally, because Plaintiffs are organized under the laws of the United States and IPCom is organized under the laws of a foreign nation, this Court has jurisdiction to hear this case pursuant to 28 U.S.C. § 1332.

21. To the extent any of Plaintiffs' claims are deemed to arise under state law, this Court has subject matter jurisdiction over those claims pursuant to 28 U.S.C. § 1367, because such claims arise from the same factual nucleus as Plaintiffs' federal law claims.

22. This Court has personal jurisdiction over IPCom based on its national contacts with the United States as a whole pursuant to Fed. R. Civ. P. 4(k)(2). Additionally, this Court has personal jurisdiction over IPCom based on its national contacts with the United States as a whole pursuant to 15 U.S.C. § 22.

23. Venue is proper in this judicial district pursuant to 28 U.S.C. § 1391(c).

24. Upon information and belief, IPCom has conducted and continues to conduct business within the United States such that IPCom has purposefully availed

itself to the privileges of conducting activities in the United States as a whole and has purposefully directed specific activities to the United States as a whole.

INTRADISTRICT ASSIGNMENT

25. Assignment to the San Jose Division is proper. This action arises in Santa Clara County because a substantial part of the events or omissions which give rise to the claim occurred in Santa Clara County. Plaintiffs have a large development lab in San Jose, California, as well as corporate offices in Sunnyvale, California.

FACTUAL ALLEGATIONS

26. As explained below, Plaintiffs bring this action because of IPCom's breach of its commitments to license patents it has asserted to be essential to the 2G, 3G, and 4G cellular standards under FRAND terms and conditions, and also for a declaration that Plaintiffs do not infringe such patents.

Overview of Standard Setting Organizations and Relevant Standards

27. Cellular communications depend on widely distributed networks that implement cellular communications standards. These standards promote availability and interoperability of standardized products regardless of geographic boundary. Cellular standards have evolved over generations, beginning with the "first generation"—or "1G"—standards developed in the 1980s. *See In re Qualcomm Antitrust Litig.*, 292 F. Supp. 3d 948, 955 (N.D. Cal. 2017). Second, third, and fourth generation standards followed.

28. Industry groups called standard-setting organizations, or SSO's, have emerged to develop and manage the relevant cellular standards. SSOs are voluntary membership organizations whose participants engage in the selection and development of industry technical standards, such as cellular communication standards, which provide important benefits by resolving interoperability problems. One of the primary SSOs in the cellular communications area is the European Telecommunications Standards Institute ("ETSI").

29. As work began on third generation—or "3G"—cellular communication standards, collaborations of SSOs formed to ensure global standardization. One such collaboration is the Third Generation Partnership Project ("3GPP"). As 4G technology emerged, 3GPP also developed the 4G LTE family of standards. Another collaboration, the Third Generation Partnership Project 2 ("3GPP2"), focused its 3G standardization efforts on the CDMA2000 standard.

30. Individual member SSOs of 3GPP and 3GPP2 are known as Organizational Partners. An Organizational Partner approves and maintains the 3GPP or 3GPP2 scope and transposes 3GPP or 3GPP2 technical specifications into the Organizational Partner's own standards. ETSI is an organizational partner of 3GPP.

31. Prior to the adoption of 2G standards, 1G cellular connectivity offered relatively basic functionality, supporting just a few analog signals (as opposed to the digital signals used today). In the late 1980s, the cellular industry began moving towards 2G and considered a number of different standards, including the Global System for Mobile communications ("GSM"), the Generalized Packet Radio System ("GPRS"), Enhanced GPRS ("EDGE"), and Code Division Multiple Access ("CDMA"). Ultimately GSM and CDMA became the primary standards in 2G cellular communications. The two 2G standards were not interoperable; thus a device configured for one network would not operate on the other.

32. In the late 1990s, the cellular industry pushed towards 3G, which offered higher transmission speeds, ability to support more users, and improved reliability. The leading 3G standards families were CDMA2000 and the Universal Terrestrial Radio Access ("UTRA"), which operated in various modes around the world, including Wideband CDMA ("WCDMA") and TD-SCDMA. The WCDMA standard was also known as Universal Mobile Telecommunications System ("UMTS"), with High Speed Packet Access ("HSPA") which utilized at least two protocols: High Speed Downlink Packet Access ("HSDPA") and High Speed

Uplink Packet Access ("HSUPA"). Once again, the two main 3G standards were not interoperable, and thus a device configured for a CDMA2000 network would not function on a UMTS network.

33. In the late 2000s, the cellular industry came together for 4G to develop a single standard: Evolved UTRA ("E-UTRA"), more commonly referred to as Long Term Evolution ("LTE"). LTE was adopted almost universally as the 4G cellular communication standard.

The Importance of FRAND Commitments in the Context of Voluntary Standard Setting

34. Although standards deliver economic benefits, they can also present significant anticompetitive risks that potentially impose excessive and unfair costs on users of the standards, and even hinder broad implementation of the standards. SSO members often own or hold patents covering the technologies adopted by the standards, creating a potential for opportunistic behavior whereby the owners of essential technology attempt to capture not only the value of the patented technology, but also the value of standardization itself. Such opportunistic behavior could involve refusing to license certain users of the standards, or demanding supra-FRAND royalties that are disproportionate to the value of the essential technology at issue.

35. In order to prevent the owner of a patent essential to complying with the standard—the "SEP holder"—from blocking or otherwise inhibiting implementation of a given standard, the relevant cellular SSOs maintain IPR policies which impose certain duties on SEP holders. Such policies require and/or strongly encourage each party that participates in the standard-development process to disclose on a timely, bona fide basis, all intellectual property rights they are aware of and believe may be essential to a proposed standard. *See, e.g.*, ETSI IPR Policy, § 4.1.

36. The relevant SSO IPR policies additionally require members with essential IPR to commit to license their asserted SEPs to firms implementing the standard on FRAND terms and conditions. *See, e.g.*, ETSI IPR Policy, § 6.1. These FRAND commitments are recognized as encumbrances that bind all successors-in-interest to such asserted SEPs. *See, e.g.*, ETSI IPR Policy, § 6.1bis.

37. By voluntarily undertaking FRAND licensing commitments, SEP holders benefit from the broad implementation of their patented technologies as a result of standardization, which significantly expands the pool of licensees to all those who produce and sell standard-compliant products. In exchange, SEP holders agree not to abuse the market power they gain as a result of the patent's incorporation into the standard to the exclusion of other alternatives.

38. These FRAND commitments provide firms that implement the standard—such as Plaintiffs — the assurance that they will always have access to the essential technology and will not be exploited by patent holders or disadvantaged relative to others if they invest in implementing the standard or developing innovative products that may operate with the standard.

39. Where SEPs are not available for FRAND licensing, the relevant SSOs have an obligation to reassess, and then revise or even abandon the portions of their standards that rely on such essential proprietary technologies. For example, under the ETSI IPR Policy, "[w]here prior to the publication of a STANDARD or a TECHNICAL SPECIFICATION, an IPR owner informs ETSI that it is not prepared to license an IPR" on FRAND terms pursuant to the policy, ETSI is required to select another "viable alternative technology" solution "which is not blocked by that IPR and satisfies ETSI's requirements." ETSI IPR Policy, § 8.1.1. If no such viable solution exists, then work on the standard "shall cease[.]"

40. Thus, by making an affirmative and voluntary FRAND commitment, an SEP holder intentionally displaces the requirement of SSO members to re-evaluate

the SSO's technical specifications when they learn of the unavailability of an essential technology under consideration.

41. Accordingly, to the extent SSO participants may not have had the opportunity to consider alternatives that were available for FRAND licensing, or to withdraw the portions of the standards where no such alternative was available, such failure was directly due to IPCom's affirmative FRAND licensing representations that induced the SSO participants to forego such opportunity.

IPCom's FRAND Commitments to ETSI

42. IPCom is obligated to license its alleged SEPs on FRAND terms and conditions. Additionally, IPCom is a successor-in-interest for certain alleged SEPs that were originally declared to be essential to the standards by previous alleged SEP holders, from whom IPCom acquired the alleged SEPs.

43. In 2007, IPCom acquired a mobile phone patent portfolio from Bosch, which included patents that IPCom alleges are essential to the GSM, UMTS, and W-CDMA standards. Bosch participated in the cellular standard setting process through at least its membership in ETSI. Further, prior to 2007, Bosch made at least eight IPR declarations to ETSI, asserting the patents or patent applications covered by those declarations were essential to the standards and committing to license these alleged essential patents on FRAND terms and conditions. Indeed, in 1998, Bosch made a general declaration, confirming its commitment to the ETSI IPR Policy, namely, its preparedness to offer licenses on FRAND terms and conditions to all of its patents that may be deemed essential to the TD/CDMA and/or W-CDMA cellular standards. *See* ETSI Declaration Ref. No. GD-190001-027, dated Jan. 27, 1998. Upon information and belief, at least some of the patents IPCom acquired from Bosch are subject to the FRAND commitments made by Bosch. Therefore, IPCom, as a successor-in-interest to these rights, is also obligated to offer licenses to these patents on FRAND terms and conditions.

44. In 2013, IPCom acquired a portfolio of mobile telecommunication patents from Hitachi. Hitachi participated in the cellular standard setting process through at least its membership in ETSI. Further, prior to and during 2013, Hitachi made at least two IPR declarations to ETSI, asserting the patents or patent applications covered by those declarations were essential to the standards and committing to license these alleged essential patents on FRAND terms and conditions. Indeed, in 1998, Hitachi made a general declaration that it was ready and willing to license its intellectual property rights necessary to implement the 3G cellular standards, including UMTS and W-CDMA, on FRAND terms and conditions. *See* ETSI Declaration Ref. No. GD-190001-013, dated June 26, 1998. Some of the patents IPCom acquired from Hitachi are subject to the FRAND commitments made by Hitachi. Therefore, IPCom, as a successor-in-interest to these rights, is also obligated to offer licenses to these patents on FRAND terms and conditions.

45. On December 10, 2009, IPCom made its own FRAND declaration regarding the patents it acquired from Bosch. *See* https://www.ipcom-munich.com/patent-licensing. IPCom alleged that the Bosch patents are essential to at least the 2G and 3G cellular standards and declared that it is fully prepared to grant licenses under these patents on FRAND terms and conditions "as if IPCom had been the original participant in the setting of the GSM and UMTS Standards and was subject to a commitment vis-à-vis ETSI to do so." *Id.* ¶ 4.

46. Additionally, on November 6, 2014, IPCom made another IPR declaration to ETSI, committing to license any of its intellectual property rights related to "all ETSI standards and technical specifications" on FRAND terms and conditions. *See* ETSI Declaration Ref. No. GD-201406-0001, dated Nov. 6, 2014.

47. All of the alleged SEPs which IPCom attempts to license are encumbered by FRAND obligations. Moreover, IPCom has represented as such on its website, with a page titled "WE ARE FRAND," stating that "FRAND is a

responsibility, and one which should be shared by everyone in the industry . . . ." *See* https://www.ipcom-munich.com/patent-licensing. Accordingly, IPCom is obligated to license its patents on FRAND terms and conditions.

IPCom's Refusal to Offer Plaintiffs a License on FRAND Terms and Conditions

48. IPCom is required to license its alleged SEPs consistent, in all respects, with the binding commitments made to ETSI directly by IPCom and/or by IPCom's predecessors-in-interest. However, in disregard of its binding obligations, IPCom is refusing to license its alleged SEPs on FRAND terms and conditions. Instead, IPCom is attempting to exploit its market power gained as a result of its alleged SEPs' incorporation into the cellular standards to attempt to extract supra-competitive royalties from Plaintiffs.

49. In or about mid-2017, IPCom's outside counsel in China contacted Plaintiffs' legal office in China regarding a license to IPCom's patent portfolio. After being instructed that Lenovo's senior intellectual property counsel is located in the United States, IPCom began to correspond with Lenovo's United States legal department in early 2018. During 2018, Lenovo and IPCom exchanged correspondence and patent claim information. However, IPCom did not provide an official licensing proposal until a meeting in Germany in September 2018.

50. After negotiations regarding IPCom's September 2018 offer, IPCom sent an email on March 1, 2019, with its final license agreement offer. The licensing offer was for a lump sum royalty payment. IPCom made clear in the email that it was not willing to further negotiate this offer. Further, IPCom stated that it had internal approval for litigation against Plaintiffs and reminded Plaintiffs of IPCom's patent litigation activity, apparently to give teeth to its threat of litigation. IPCom gave Plaintiffs just two weeks to accept the licensing offer—until March 15, 2019—before IPCom would, presumably, initiate litigation to force Plaintiffs' hand

into accepting its offer. Plaintiffs are not willing to accept the supra-competitive, non-FRAND royalty rates offered in IPCom's March 1, 2019 email.

51. In addition to its supra-competitive royalty demands, IPCom is attempting to extract royalties from Plaintiffs for patents that are, or will, expire. A number of the patent families identified by IPCom include patents that already have expired or will expire soon. Despite this, IPCom does not account for expired patents in its calculation for past royalties and arbitrarily reduces future royalty rate calculations to purportedly recognize that many of its patents will expire. IPCom's arbitrary accounting for expired and expiring patents does not comply with its obligation to license on FRAND terms and conditions.

52. Further, IPCom is demanding royalties for alleged SEPs which it has not shown cover portions of any relevant ETSI standards. To date, of the over 170 patent families identified in IPCom's proposed license to Plaintiffs, only 32 have been specifically identified as allegedly containing SEPs. Further, of these 32 identified families, IPCom has only provided claim charts purporting to map the cellular standards for patents from five of these families. For the rest of the 32 patent families, IPCom provides nothing more than a conclusory assertion that the patents are relevant to a given ETSI standard. After even a cursory review of some of these patents, it is readily apparent that they are not actually essential to the standards. As such, IPCom is attempting to extract royalty rates for these remaining patent families without even a bare showing that the patents cover the relevant cellular standard. Indeed, upon information and belief, many of the non-charted patent families are not essential to the standards that IPCom claims, and may be invalid or otherwise not utilized or infringed by Plaintiffs.

53. Additionally, IPCom's royalty rates fail to account for prior licenses that may release Plaintiffs from infringement liability for certain patents asserted by IPCom. Plaintiffs are licensed under various 2G—and possibly 3G—patents in IPCom's portfolio. To the extent IPCom disagrees or bases its royalty calculations

on its portfolio of 2G patents, IPCom's licensing offer violates its FRAND obligations by seeking royalties on patents as to which Plaintiffs are already licensed.

54. Further, IPCom's licensing demand is not consistent with similarly-situated SEP licensing agreements recently entered into by Plaintiffs and IPCom has not demonstrated it is offering Plaintiffs the same and/or non-discriminatory rates that IPCom has provided Plaintiffs' competitors (or other similarly situated companies).

55. IPCom's conduct during negotiations with Plaintiffs also cannot be reconciled with its commitment to license on FRAND terms. In February 2019, just before IPCom made its "final" licensing offer on March 1, 2019, IPCom contacted one of Plaintiffs' customers. IPCom informed this customer that it was at serious legal and financial risk by selling Plaintiffs' unlicensed products. IPCom instructed the customer to contact its supplier (i.e., Plaintiffs) to determine its licensing status, and thus the customer's potential exposure. Upon information and belief, IPCom knew at this time that it was in the middle of licensing negotiations with Plaintiffs and that less than two weeks later IPCom would render its "final" licensing offer to Plaintiffs. This blatant attempt to use Plaintiffs' customer relationships to coerce Plaintiffs into accepting IPCom's upcoming supra-competitive license offer does not amount to good-faith negotiations as required by ETSI's IPR policy.

56. IPCom's licensing offers to Plaintiffs violated its commitments to ETSI and are entirely inconsistent with FRAND principles. IPCom has negotiated in bad faith to exploit its monopoly power and has attempted to maximize the hold-up value it can extract from Plaintiffs.

57. Put simply, in breach of its FRAND commitment, IPCom is attempting to exploit the monopoly power it gained through the alleged standardization of its patents to demand supra-competitive royalty rates which are grossly disproportionate to the value of the technical contribution of its small number of

alleged SEPs. Given these clear hold-up conditions, Plaintiffs have no choice but to file this action.

FIRST CAUSE OF ACTION

(Breach of Contract)

58. Plaintiffs re-allege and incorporate by reference the allegations set forth in the foregoing paragraphs.

59. IPCom entered into, or is bound by, contractual commitments made to ETSI and its respective members, participants, and implementers relating to the 2G, 3G, and 4G standards. To comply with the IPR Policies of ETSI, IPCom either made or is encumbered by a binding commitment to ETSI, its members, and third-party implementers to grant irrevocable licenses to all such users of cellular standards purportedly covered by IPCom's alleged SEPs on FRAND terms and conditions.

60. The declarations made pursuant to such IPR Policies created an express and/or implied contract with ETSI and its members, including an agreement that IPCom would license those patents on FRAND terms and conditions. The IPR Policies of ETSI do not limit the right to obtain a license on FRAND terms and conditions to their members; third parties that are not members also have the right to be granted licenses under those patents on FRAND terms and conditions. Each and every party with products that implement the 2G, 3G, and 4G standards promulgated by such SSOs is therefore an intended third-party beneficiary of IPCom's contractual commitments, including Plaintiffs, their suppliers, and their customers.

61. Despite Plaintiffs' good faith efforts to negotiate a license to IPCom's alleged SEPs, IPCom has failed and refused to offer Plaintiffs terms that comply with IPCom's FRAND obligations.

62. Therefore, IPCom has breached its obligations to ETSI by failing and refusing to offer a license to IPCom's alleged SEPs on FRAND terms and

conditions. This constitutes a breach of IPCom's FRAND obligations, of which Plaintiffs are intended third-party beneficiaries.

63. As a result of IPCom's contractual breaches, Plaintiffs have been injured in their business or property and are threatened by imminent loss of profits, loss of customers and potential customers, the imposition of non-FRAND terms and conditions, and loss of goodwill and product image.

64. Plaintiffs have suffered and will continue to suffer irreparable injury by reason of the acts, practices, and conduct of IPCom alleged above until and unless the Court enjoins such acts, practices, and conduct. Namely, Plaintiffs request (1) that this Court order IPCom to offer Plaintiffs a license on FRAND terms and conditions, and (2) an adjudication of the FRAND terms and conditions for such a license.

SECOND CAUSE OF ACTION

(Declaratory Judgment)

65. Plaintiffs re-allege and incorporate by reference the allegations set forth in the foregoing paragraphs.

66. IPCom is contractually obligated to license its 2G, 3G, and 4G alleged SEPs on FRAND terms and conditions. As a result of the acts described in the foregoing paragraphs, there exists a definite and concrete, real and substantial, justiciable controversy between Plaintiffs and IPCom regarding what constitutes FRAND terms and conditions for a license to IPCom's alleged 2G, 3G, and 4G SEPs. This dispute is of sufficient immediacy and reality to warrant the issuance of a declaratory judgment.

67. Plaintiffs are entitled to a declaratory judgment with respect to (1) a determination that IPCom has not offered Plaintiffs a license to its alleged 2G, 3G, and 4G SEPs on FRAND terms and conditions; (2) a determination of what constitutes FRAND terms and conditions for a license to IPCom's alleged 2G, 3G, and 4G SEPs, with those terms and conditions being imposed on the parties; and (3)

a determination that the FRAND terms and conditions must be consistent with well-established apportionment principles under federal patent law (*i.e.*, the smallest salable patent practicing unit rule).

THIRD CAUSE OF ACTION

(Antitrust Monopolization in Violation of Section 2 of the Sherman Act)

68. Plaintiffs re-allege and incorporate by reference the allegations set forth in the foregoing paragraphs.

69. This is an action for antitrust monopolization in violation of Section 2 of the Sherman Act.

70. As a member of ETSI, IPCom was obligated to comply with the ETSI IPR Policy. That policy requires the owner of patents that might be essential to a standard to file an IPR disclosure statement that among other things contains an irrevocable commitment to be prepared to license the disclosed IPRs on FRAND terms and conditions to those who implement the relevant standards. Over time, to secure inclusion of the technology covered by its patents in the evolving 2G, 3G, and 4G standards, as well as other technology allegedly covered by its patents, IPCom, or its predecessors-in-interest, submitted IPR Declarations promising to license the patents on FRAND terms and conditions. As a result of the IPR disclosures, the technology covered by patents now owned or controlled by IPCom was incorporated into the standards, and other alternative technologies that might otherwise have been considered for inclusion in the standard were not adopted.

71. These promises and obligations to license the allegedly essential patents on FRAND terms and conditions were intentionally false and misleading. Indeed, IPCom has no intention of licensing its alleged SEPs on FRAND terms and conditions.

72. Indeed, as explained above, with Plaintiffs, IPCom is attempting to exploit its undue monopoly power by attempting to extract supra-competitive royalty rates, to force Plaintiffs to pay royalties on expired patents, and to charge

Plaintiffs royalty rates that fail to take into account various mitigating circumstances, among other FRAND violations.

73. As a result of the alleged incorporation of the patented technology into the 2G, 3G, and 4G standards, IPCom has monopoly power in the markets for those technologies. As a result of its alleged incorporation in the standards, this technology is not interchangeable with or substitutable for other technologies, and those who comply with the 2G, 3G, and 4G standards are locked in to those technologies. As a result, IPCom has the power to extract supra-competitive prices for licenses to those technologies. Accordingly, IPCom has a dominant market share in the markets for these technologies and the markets have significant barriers to entry post-standardization.

74. IPCom has obtained and maintained its market power in these technology markets willfully and not as a consequence of a superior product, business acumen, or historic accident. Competition has been excluded through the intentional false promise to license the relevant technologies on FRAND terms, which ETSI and its members relied on in choosing to incorporate standard-compliant technology related to the allegedly patented technology now owned by IPCom. This deceptive conduct induced 3GPP and ETSI, through the voluntary consensus-driven processes they use, to incorporate technology into the 3G and 4G standards that they would not have absent a FRAND commitment.

75. IPCom's actions show that it has never intended to comply with its obligations to license its allegedly essential patents on FRAND terms and conditions. IPCom refuses to engage with Plaintiffs' good faith efforts to determine fair, reasonable, and non-discriminatory terms and conditions. Instead, IPCom is insisting that Plaintiffs pay royalty rates that are several times higher than justified by the strength of IPCom's alleged SEPs.

76. These anticompetitive acts are an abuse of IPCom's monopoly power in the relevant worldwide markets and establish a violation of Section 2 of the Sherman Act.

Relevant Technology Markets

77. For the purposes of Plaintiffs' antitrust claim, the relevant markets are the technologies covered by IPCom's declared essential patents—inclusive of those issued in the United States and elsewhere—that IPCom has asserted against Plaintiffs for purposes of products that implement the 2G, 3G, and 4G standards, together with all other alternative technologies to the IPCom technologies that could have been incorporated into the standards (the "Relevant Technology Markets").

78. Once ETSI adopts technology for a mobile standard, the owner of each essential patent whose technology is incorporated into that standard obtains monopoly power in a relevant technology market. When patented technology is incorporated in a standard, adoption of the standard eliminates alternatives to the patented technology, and companies wanting to market devices that comply with the standard are locked in and must use the SEPs.

79. As previously discussed, IPCom has either directly or through its predecessors-in-interest declared many of its patents to be essential to one or more of the standards and made irrevocable undertakings to license those patents on FRAND terms. If IPCom's declarations are correct, then the market encompassed within the Relevant Technology Markets can be identified from IPCom's or its predecessors-in-interests' declarations to ETSI, the patents associated therewith, and IPCom's allegations of essentiality during licensing negotiations with Plaintiffs.

80. Before the adoption of the standards, competitors in the Relevant Technology Markets included companies with technology capable of performing the same or equivalent functions that could have been adopted by ETSI and its members. These additional competitors include the companies that offered technologies that could have been used in alternative mobile standards that were

foreclosed once ETSI members adopted a standard that included IPCom's technologies. Because of the lock-in effect described above, IPCom became the only commercially viable seller inside and outside the United States in each of the Relevant Technology Markets.

81. After the standards were set and IPCom's technology was adopted into the standard, implementers such as Plaintiffs invested significant revenue and other resources developing products that practice the standard. Those investments were made in reliance on the commitment IPCom, its successors-in-interest, and other SEP owners made to license their patents on FRAND terms and conditions. Plaintiffs and other implementers were effectively locked into practicing IPCom's technology when it was adopted into the standard. As a result, alternatives to the patented technology no longer constrain IPCom's ability to demand royalty rates far in excess of the value of the patented technology, as the alternative technologies would have prior to the adoption of the standard ("*ex ante*").

IPCom's Antitrust Violations

82. Courts, regulators, and economists have made clear that to be effective, the FRAND commitments in ETSI's IPR policy should: (a) limit royalties to the value that the SEP(s) had prior to inclusion in the ETSI standard and in light of other patented and unpatented technology essential to the standard; (b) prohibit charging royalties that are higher based upon the technology being written into the standard or that capture the value of the standard itself; and (c) require non-discriminatory treatment of licensees and potential licensees.

83. ETSI's FRAND commitment grants implementers the right to practice claimed SEPs. Participants in standards development and third-party implementers rely on these irrevocable contractual undertakings to ensure that the widespread adoption of the standard will not be hindered by SEP owners attempting to extract unreasonable royalties and terms from those implementing the standard.

84. Plaintiffs assert this claim to obtain a FRAND license and enjoin IPCom from continuing its abusive licensing practices and unlawful monopolization in certain relevant markets for 2G, 3G, and 4G cellular technologies. IPCom has engaged in an unlawful scheme to exploit its undue market power over technologies allegedly necessary for implementers, including Plaintiffs, to practice the 2G, 3G, and 4G standards. IPCom's market power is due solely to its false commitments to license its alleged SEPs on FRAND terms and conditions, which was a necessary step in locking its technology into the standard(s).

85. Participants in the 2G, 3G, and 4G standard-setting process, including all ETSI members and Plaintiffs in particular, relied on IPCom's intentionally false promises to license the alleged SEPs on FRAND terms and conditions in choosing to incorporate those allegedly essential patented technologies into the standards. As a result of IPCom's FRAND commitments, its allegedly essential patent technology was included in the standards and alternative technologies were excluded. Through its deceptive acts and practices, IPCom is unlawfully monopolizing the Relevant Technology Markets.

86. After acquiring its unlawful monopolization of the Relevant Technology Markets, IPCom has exploited this ill-gotten power against Plaintiffs by refusing to offer a license on FRAND terms, by among other things:

- Refusing to honor its obligation to license its alleged SEPs on FRAND terms and conditions;
- Attempting to seek supra-competitive royalty rates from Plaintiffs for a license to its alleged 2G, 3G, and 4G patents;
- Demanding Plaintiffs pay royalties for alleged SEPs covering portions of the standards not practiced by Plaintiffs' products;
- Demanding Plaintiffs pay royalties for patents that are, in fact, not essential to the ETSI standards; and

- Demanding Plaintiffs pay royalties for expired patents or patents that will expire during the course of the proposed license.

87. IPCom's actions injure competition by excluding alternate technologies which could have been included in the standard. As a direct and proximate consequence of IPCom's unlawful monopolization, customers of the Relevant Technology Markets (implementers of the standards such as Plaintiffs) face drastically higher costs for access to cellular technologies necessary for the manufacture of standard-compliant products than they would have paid in a competitive marketplace.

88. IPCom's wrongful conduct prevents Plaintiffs from obtaining access to alternative technologies in the Relevant Technology markets. The antitrust injury associated with IPCom's unlawful monopolization also extends to the downstream market, for example, by reducing innovation, increasing prices, and limiting choices for standard-compliant products. Indeed, the necessary result of raising costs to some competing manufacturers in the marketplace for standard-compliant products and diverting resources that otherwise would have fueled additional innovation is to limit consumer choices in complementary technologies and other technology used in standard-compliant products.

89. IPCom has leverage over manufacturers of standard-compliant products that it would not possess but for its false promises to ETSI to license its alleged SEPs on FRAND terms and conditions, and its unlawful acquisition of monopoly power in the Relevant Technology Markets. As a result of said leverage, manufacturers of standard-compliant products, including Plaintiffs, must either capitulate to IPCom's demand for supra-competitive royalty rates or face the costs and risks of protracted patent litigation on a global scale.

90. Absent IPCom's wrongful conduct, which resulted in alternate technologies being excluded from the relevant standards, Plaintiffs would be able to

obtain a new license to access necessary technology in the Relevant Technology Markets on FRAND terms.

91. Therefore, to prevent harm to Plaintiffs' business and property, including its cellular module products, and further harm to competition more generally in the Relevant Technology Markets, Plaintiffs bring this action for treble damages, declaratory relief, and injunctive relief under Sections 4 and 16 of the Clayton Act, 15 U.S.C. §§ 15, 26.

FOURTH CAUSE OF ACTION

(Declaratory Judgment of Non-Infringement of U.S. Patent No. 6,307,844)

92. Plaintiffs re-allege and incorporate by reference the allegations set forth in the foregoing paragraphs.

93. U.S. Patent No. 6,307,844 ("'844 Patent"), attached hereto as Exhibit A, entitled "CDMA Communication System and ITS Transmission Power Control Method," indicates that it issued on October 23, 2001.

94. There is a dispute between the parties concerning whether certain of Plaintiffs products infringe one or more claims of the '844 Patent. During the course of licensing negotiations, IPCom asserted that Plaintiffs' products infringe one or more of the '844 Patent claims by virtue of practicing the UMTS standard. IPCom provided Plaintiffs with a claim chart alleging that at least claim 15 of the '844 Patent is essential to the UMTS standard.

95. Plaintiffs allege that the '844 Patent is not essential to the UMTS standard and, therefore, Plaintiffs' products, which implement the UMTS standard, do not practice one or more claims of the '844 Patent.

96. No claim of the '844 Patent has been or is infringed, either directly, contributorily, or by inducement, literally or under the doctrine of equivalents, by Plaintiffs or the purchasers of Plaintiffs' products through the manufacture, use, importation, sale, and/or offer for sale of Plaintiffs' products.

97. An actual and justiciable controversy exists between Plaintiffs and IPCom with respect to whether Plaintiffs' products infringe one or more claims of the '844 Patent.

98. Pursuant to the Federal Declaratory Judgment Act, 28 U.S.C. § 2201 *et seq.*, Plaintiffs requests the declaration of this Court that Plaintiffs' products do not infringe one or more claims of the '844 Patent.

FIFTH CAUSE OF ACTION

(Declaratory Judgment of Non-Infringement of U.S. Patent No. 6,920,124)

99. Plaintiffs re-allege and incorporate by reference the allegations set forth in the foregoing paragraphs.

100. U.S. Patent No. 6,920,124 ("'124 Patent"), attached hereto as Exhibit B, entitled "Method for Transmitting Digital Useful Data," indicates that it issued on July 19, 2005.

101. There is a dispute between the parties concerning whether certain of Plaintiffs products infringe one or more claims of the '124 Patent. During the course of licensing negotiations, IPCom asserted that Plaintiffs' products infringe one or more of the '124 Patent claims by virtue of practicing the UMTS standard. IPCom provided Plaintiffs with a chart alleging that at least claim 1 of the '124 Patent is essential to the UMTS standard.

102. Plaintiffs allege that the '124 Patent is not essential to the UMTS standard and, therefore, Plaintiffs' products, which implement the UMTS standard, do not practice one or more claims of the '124 Patent.

103. No claim of the '124 Patent has been or is infringed, either directly, contributorily, or by inducement, literally or under the doctrine of equivalents, by Plaintiffs or the purchasers of Plaintiffs' products through the manufacture, use, importation, sale, and/or offer for sale of Plaintiffs' products.

104. An actual and justiciable controversy exists between Plaintiffs and IPCom with respect to whether Plaintiffs' products infringe one or more claims of the '124 Patent.

105. Pursuant to the Federal Declaratory Judgment Act, 28 U.S.C. § 2201 *et seq.*, Plaintiffs request the declaration of this Court that Plaintiffs' products do not infringe one or more claims of the '124 Patent.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs pray for relief as follows:

A. Adjudge and decree that IPCom is liable for breach of its contractual commitments to ETSI by failing to offer FRAND terms and conditions for a license to its 2G, 3G, and/or 4G SEPs to Plaintiffs;

B. Adjudge and decree that Plaintiffs and all of their worldwide affiliates are entitled to a license from IPCom for any and all patents IPCom deems "essential" and/or has declared "essential" to the 2G, 3G, and/or 4G standards under FRAND terms and conditions pursuant to IPCom's obligations to ETSI;

C. Adjudge, set, and decree the FRAND terms and conditions to which Plaintiffs are entitled under IPCom's obligations to ETSI for a license to IPCom's 2G, 3G, and 4G SEPs, so that Plaintiffs may obtain a FRAND license on those terms;

D. Adjudge and decree that a license on FRAND terms and conditions in accordance with IPCom's obligations to ETSI must be consistent with apportionment principles under federal patent law, *i.e.*, the smallest salable patent-practicing unit rule;

E. Adjudge and decree that IPCom has not offered a license to its alleged 2G, 3G, and 4G SEPs to Plaintiffs on FRAND terms and conditions;

F. Enjoin IPCom from demanding excessive royalties from Plaintiffs and their customers that are not consistent with IPCom's FRAND obligations to ETSI;

G. Enjoin IPCom from enforcing their alleged 2G, 3G, and/or 4G SEPs against Plaintiffs and their customers via patent infringement lawsuits or other proceedings in other jurisdictions, while Plaintiffs remain a willing licensee and seek an adjudication of the FRAND terms and conditions from this Court;

H. Adjudge and decree that IPCom has violated Section 2 of the Sherman Act and enjoin IPCom from further violations of that statute;

I. Adjudge and decree that Plaintiffs do not infringe the '844 Patent;

J. Adjudge and decree that Plaintiffs do not infringe the '124 Patent;

K. Enter judgment awarding Plaintiffs their expenses, costs, and attorneys' fees under applicable laws;

L. Award Plaintiffs pre-judgment and post-judgment interest to the full extent allowed under the law, as well as their costs; and

M. For such other and further relief as the Court deems just and proper.

Dated: March 14, 2019

SHEPPARD, MULLIN, RICHTER & HAMPTON LLP

By */s/ Martin R. Bader*
MARTIN R. BADER
MATTHEW W. HOLDER
LAI YIP

Attorneys for Plaintiffs Lenovo (United States) Inc. and Motorola Mobility, LLC

DEMAND FOR JURY TRIAL

PLEASE TAKE NOTICE that Plaintiffs hereby demand a trial by jury.

Dated: March 14, 2019

SHEPPARD, MULLIN, RICHTER & HAMPTON LLP

By /s/ *Martin R. Bader* .
MARTIN R. BADER
MATTHEW W. HOLDER
LAI YIP

Attorneys for Plaintiffs Lenovo (United States) Inc. and Motorola Mobility, LLC

EXHIBIT A

US006307844B1

(12) **United States Patent**
Tsunehara et al.

(10) **Patent No.: US 6,307,844 B1**
(45) **Date of Patent: Oct. 23, 2001**

(54) **CDMA COMMUNICATION SYSTEM AND ITS TRANSMISSION POWER CONTROL METHOD**

(75) Inventors: **Katsuhiko Tsunehara**, Yokohama; **Takashi Yano**, Tokorozawa; **Nobukazu Doi**, Hachioji; **Takaki Uta**, Yokohama; **Keiji Hasegawa**, Higashimurayama, all of (JP)

(73) Assignee: **Hitachi, Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/985,281**

(22) Filed: **Dec. 4, 1997**

(30) **Foreign Application Priority Data**

Dec. 6, 1996 (JP) 8-326493

(51) **Int. Cl.**[7] **H04B 7/185**; H04B 7/216
(52) **U.S. Cl.** **370/318**; 370/335
(58) **Field of Search** 379/318, 311, 379/320, 322, 332, 333, 335, 342; 455/69, 70, 115, 432, 522, 13.4

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"Development on CDMA Packet Mobile Communication System", by Yano et al, Communication Society Meeting, Institute of Electronics, Information and Communication Engineers, B–389 (1996).

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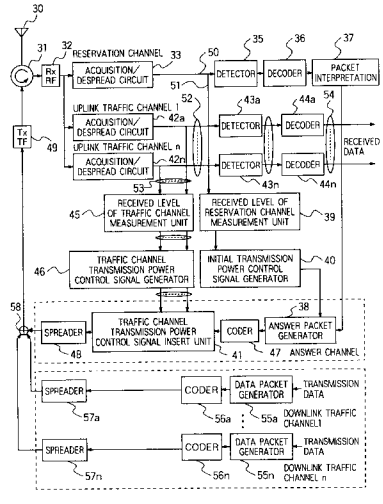
Primary Examiner—Chau Nguyen
Assistant Examiner—Chiho Andrew Lee
(74) *Attorney, Agent, or Firm*—Mattingly, Stanger & Malur, P.C.

(57) **ABSTRACT**

An uplink channel transmission power control method is provided for a CDMA mobile communication system performing one way communication. A base station measures the received level of data transmitted from each mobile terminal at each channel, and generates a transmission power control signal of each uplink traffic channel. The generated transmission power control signals are multiplexed, and the multiplexed common transmission power control signal is transmitted to all mobile terminals by using the common channel shared by the mobile terminals. Each mobile terminal derives the transmission power control signal of the uplink traffic channel used by the terminal, from the received common transmission power control signal, and controls the transmission power of a data packet.

25 Claims, 10 Drawing Sheets



PRIOR ART

FIG. 1

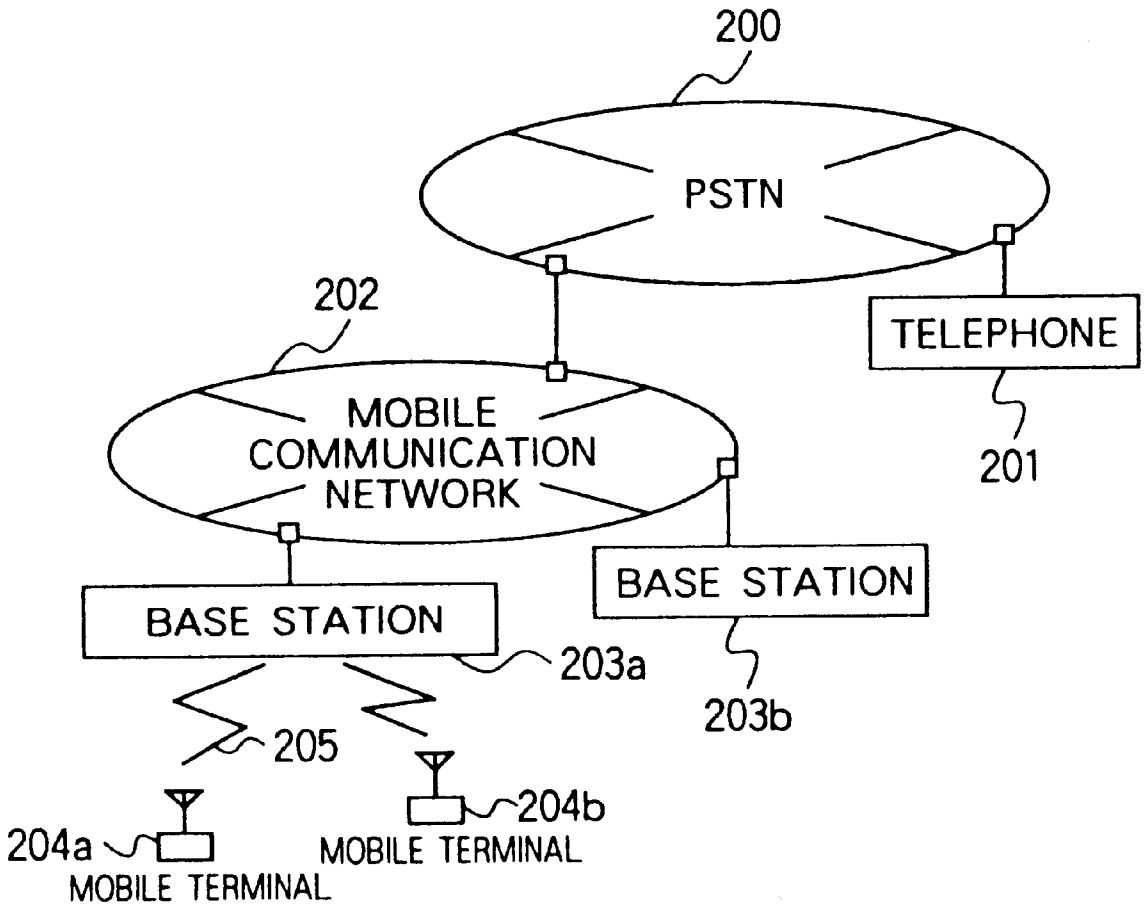
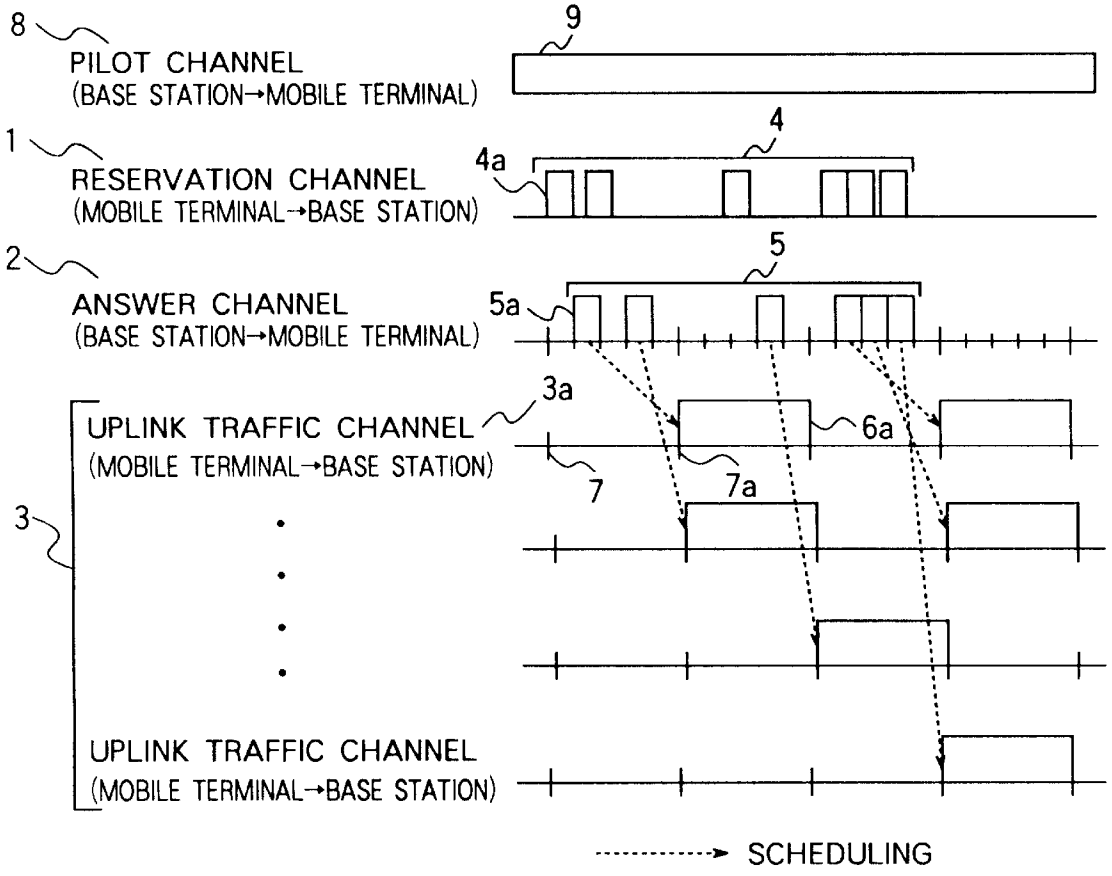


FIG. 2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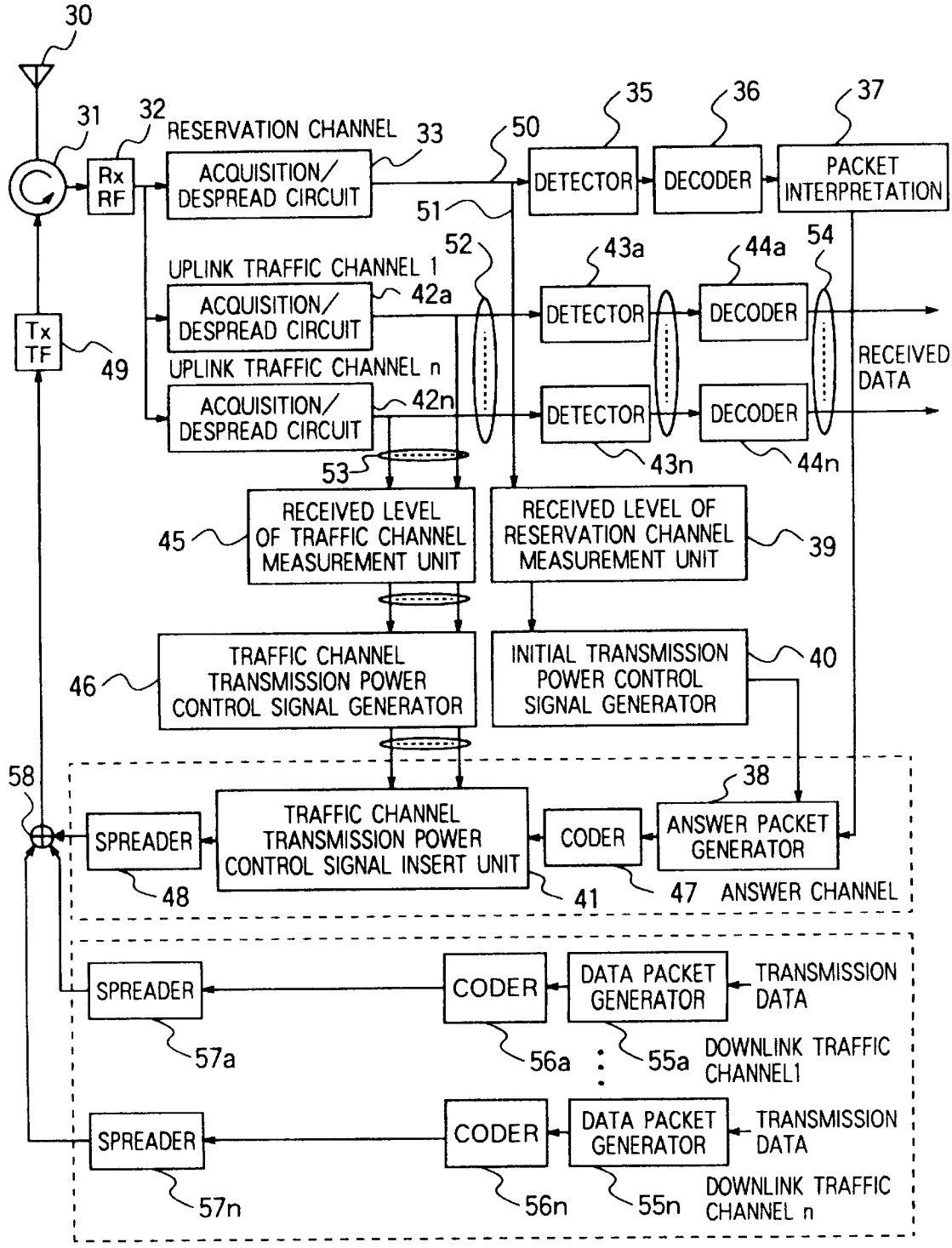
PILOT CHANNEL
(BASE STATION→MOBILE TERMINAL)
9
1
RESERVATION CHANNEL
(MOBILE TERMINAL→BASE STATION)
4a
4
2
ANSWER CHANNEL
(BASE STATION→MOBILE TERMINAL)
5a
5
3a
UPLINK TRAFFIC CHANNEL
(MOBILE TERMINAL→BASE STATION)
6a
7
7a
3
UPLINK TRAFFIC CHANNEL
(MOBILE TERMINAL→BASE STATION)
SCHEDULING

FIG. 3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31
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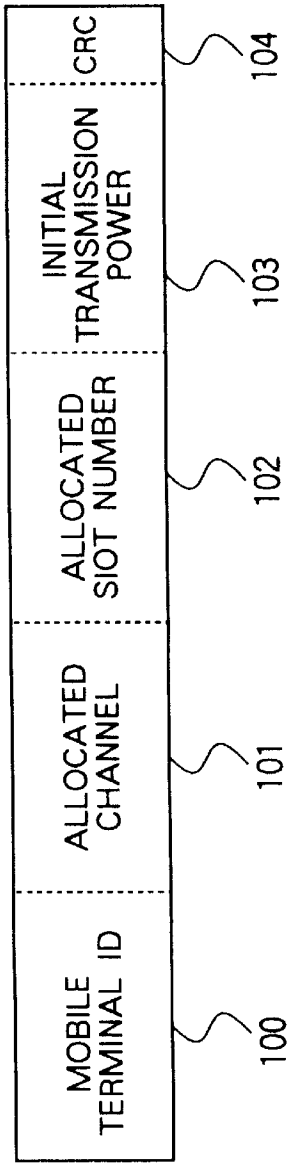
Rx RF
ACQUISITION/ DESPREAD CIRCUIT
DETECTOR
DECODER
PACKET INTERPRETATION
51
52
43a
44a
54
UPLINK TRAFFIC CHANNEL 1
42a
ACQUISITION/ DESPREAD CIRCUIT
DETECTOR
DECODER
Tx TF
49
UPLINK TRAFFIC CHANNEL n
42n
RECEIVED DATA
ACQUISITION/ DESPREAD CIRCUIT
DETECTOR
DECODER
53
43n
44n
45
RECEIVED LEVEL OF TRAFFIC CHANNEL MEASUREMENT UNIT
RECEIVED LEVEL OF RESERVATION CHANNEL MEASUREMENT UNIT
39
46
TRAFFIC CHANNEL TRANSMISSION POWER CONTROL SIGNAL GENERATOR
INITIAL TRANSMISSION POWER CONTROL SIGNAL GENERATOR
40
58
38
SPREADER
TRAFFIC CHANNEL TRANSMISSION POWER CONTROL SIGNAL INSERT UNIT
CODER
ANSWER PACKET GENERATOR
48
41
47
ANSWER CHANNEL
SPREADER
CODER
DATA PACKET GENERATOR
TRANSMISSION DATA
57a
56a
55a
DOWNLINK TRAFFIC CHANNEL1
SPREADER
CODER
DATA PACKET GENERATOR
TRANSMISSION DATA
57n
56n
55n
DOWNLINK TRAFFIC CHANNEL n

FIG. 4


MOBILE TERMINAL ID
ALLOCATED CHANNEL
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INITIAL TRANSMISSION POWER
CRC
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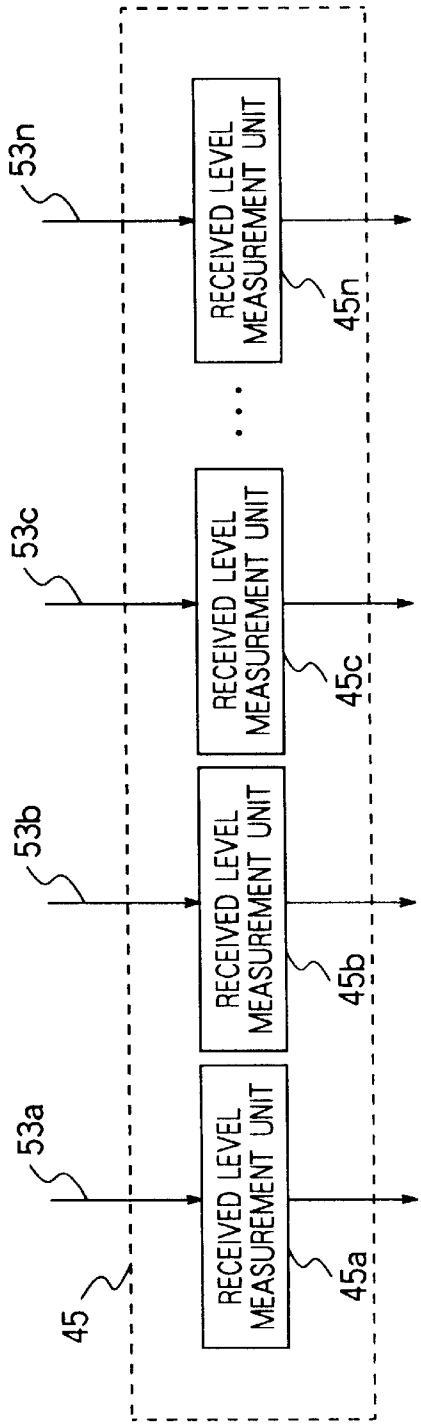
FIG. 5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53c
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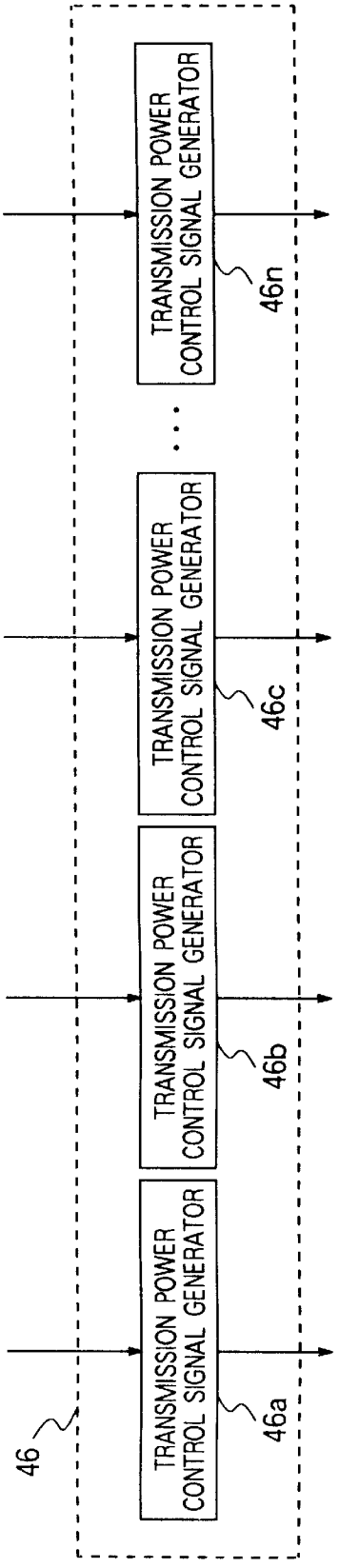
45b
45c
45n

FIG. 6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46a
TRANSMISSION POWER CONTROL SIGNAL GENERATOR
46b
TRANSMISSION POWER CONTROL SIGNAL GENERATOR
46c
TRANSMISSION POWER CONTROL SIGNAL GENERATOR
46n

FIG. 7

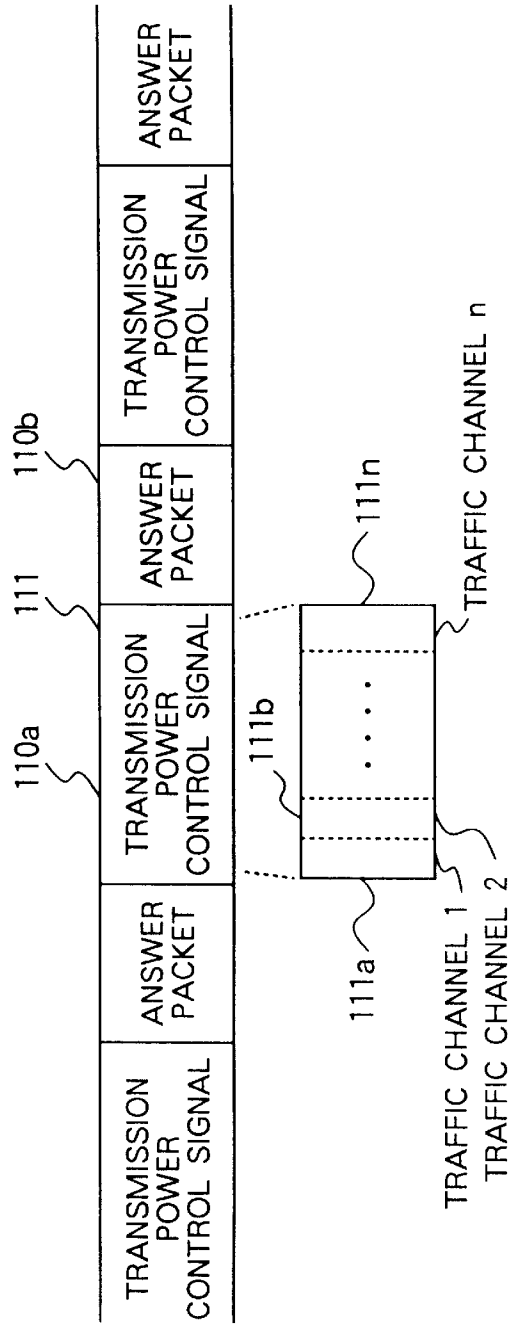
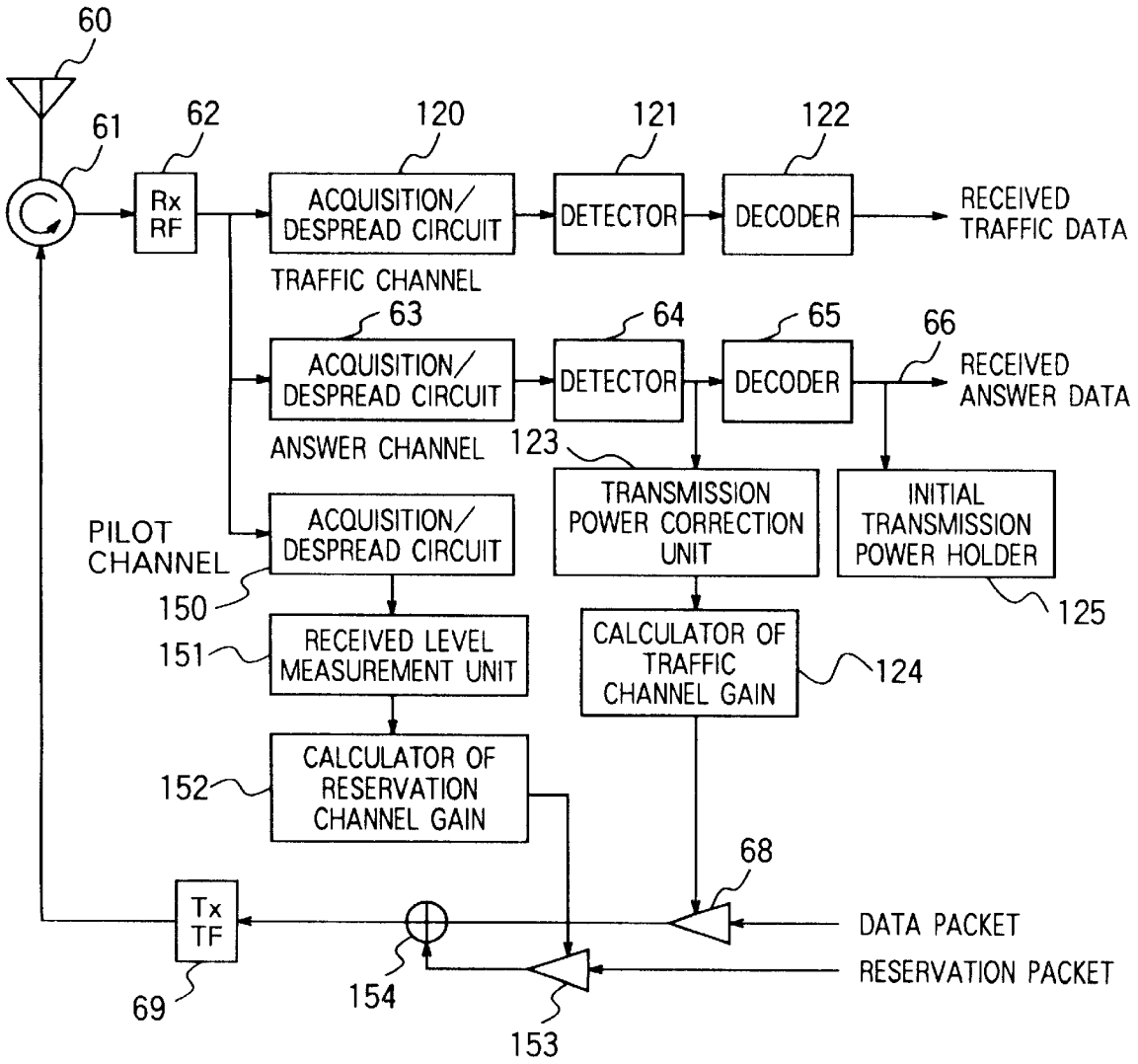

TRANSMISSION POWER CONTROL SIGNAL
ANSWER PACKET
TRANSMISSION POWER CONTROL SIGNAL
ANSWER PACKET
TRANSMISSION POWER CONTROL SIGNAL
ANSWER PACKET
110a
110b
111
111a
111b
111n
TRAFFIC CHANNEL 1
TRAFFIC CHANNEL 2
TRAFFIC CHANNEL n

FIG. 8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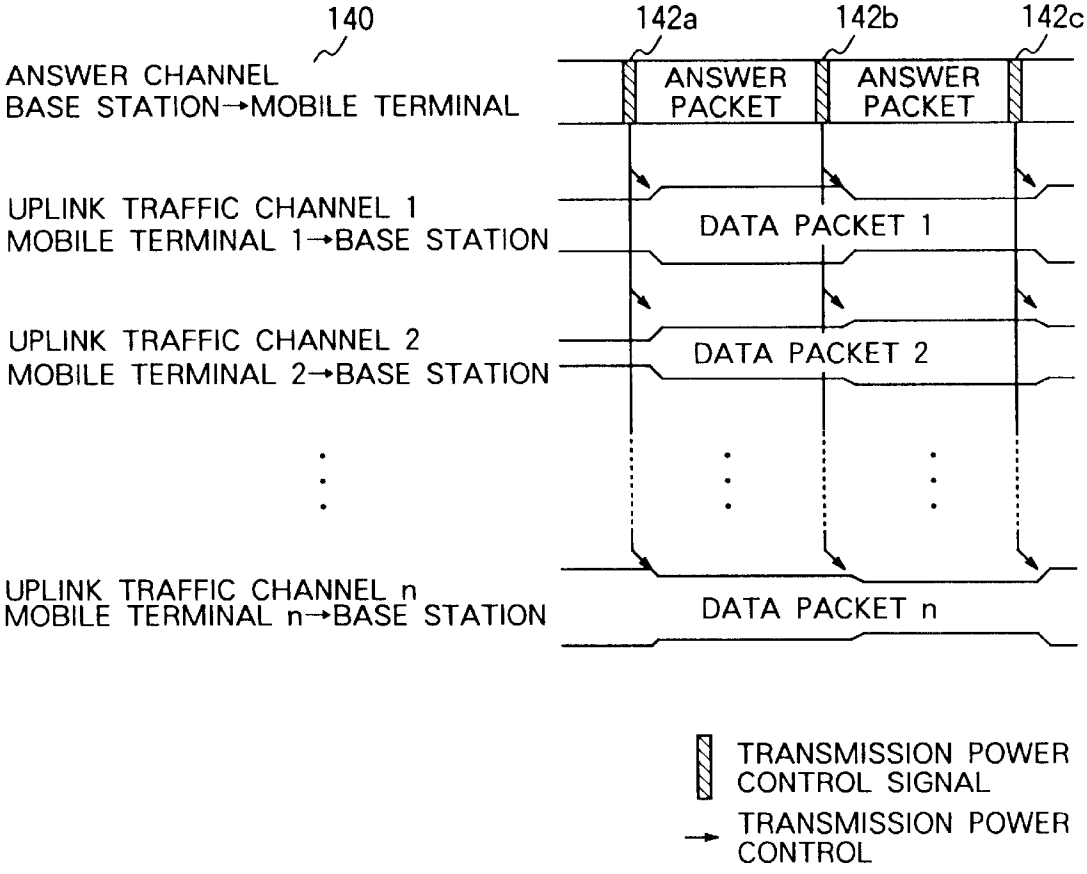
62
120
121
122
Rx RF
ACQUISITION/ DESPREAD CIRCUIT
DETECTOR
DECODER
RECEIVED TRAFFIC DATA
TRAFFIC CHANNEL
63
64
65
66
ACQUISITION/ DESPREAD CIRCUIT
DETECTOR
DECODER
RECEIVED ANSWER DATA
ANSWER CHANNEL
123
TRANSMISSION POWER CORRECTION UNIT
INITIAL TRANSMISSION POWER HOLDER
125
PILOT CHANNEL
ACQUISITION/ DESPREAD CIRCUIT
150
151
RECEIVED LEVEL MEASUREMENT UNIT
CALCULATOR OF TRAFFIC CHANNEL GAIN
124
152
CALCULATOR OF RESERVATION CHANNEL GAIN
68
Tx TF
DATA PACKET
RESERVATION PACKET
69
154
153

FIG. 9


140
142a
142b
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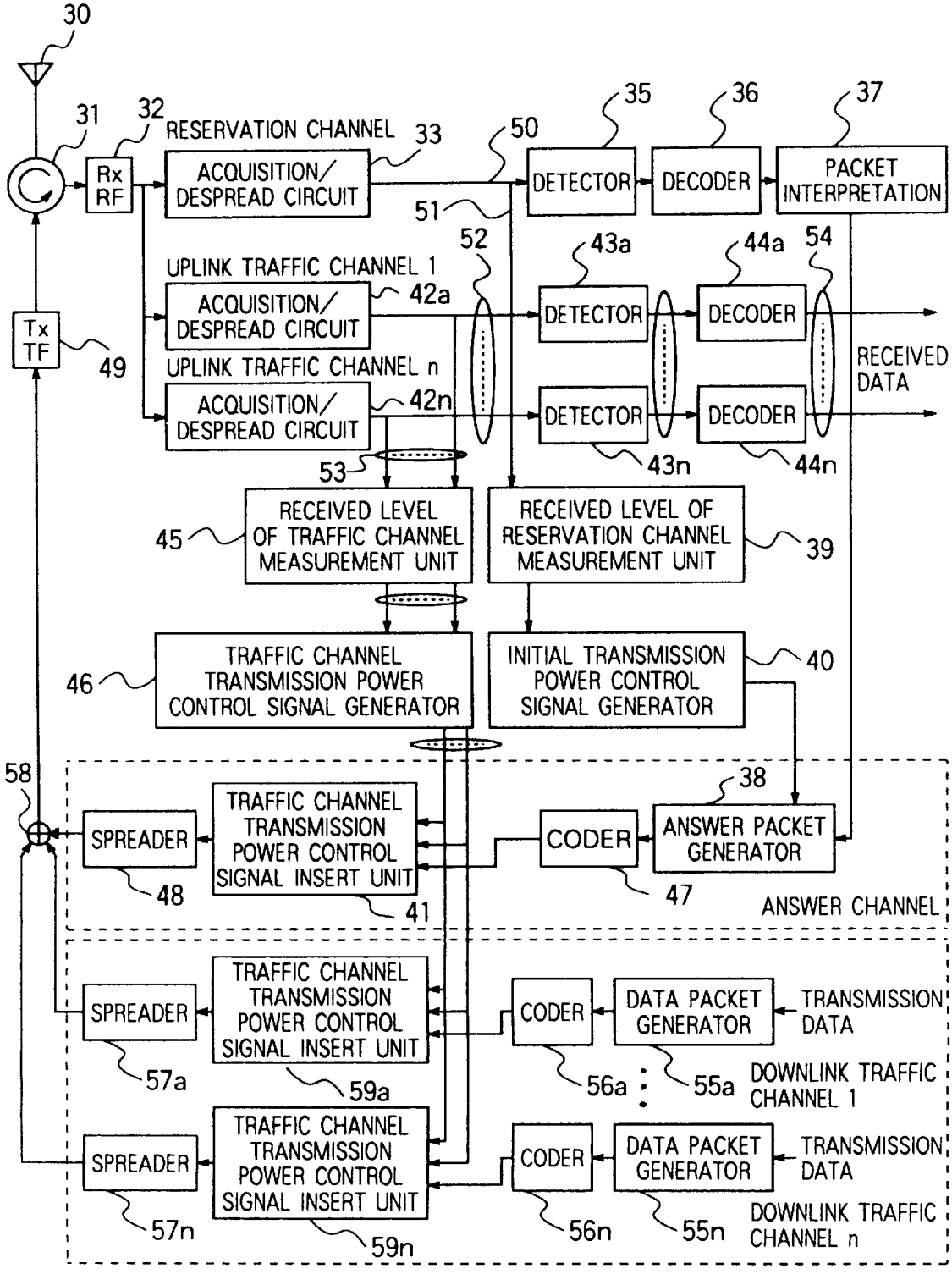
ANSWER CHANNEL
BASE STATION→MOBILE TERMINAL
ANSWER PACKET
ANSWER PACKET
UPLINK TRAFFIC CHANNEL 1
MOBILE TERMINAL 1→BASE STATION
DATA PACKET 1
UPLINK TRAFFIC CHANNEL 2
MOBILE TERMINAL 2→BASE STATION
DATA PACKET 2
UPLINK TRAFFIC CHANNEL n
MOBILE TERMINAL n→BASE STATION
DATA PACKET n
TRANSMISSION POWER CONTROL SIGNAL
TRANSMISSION POWER CONTROL

FIG. 10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DETECTOR
DECODER
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51
52
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44a
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ACQUISITION/ DESPREAD CIRCUIT
42a
DETECTOR
DECODER
Tx TF
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42n
DETECTOR
DECODER
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RECEIVED LEVEL OF RESERVATION CHANNEL MEASUREMENT UNIT
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CODER
DATA PACKET GENERATOR
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59a
56a
55a
DOWNLINK TRAFFIC CHANNEL 1
SPREADER
TRAFFIC CHANNEL TRANSMISSION POWER CONTROL SIGNAL INSERT UNIT
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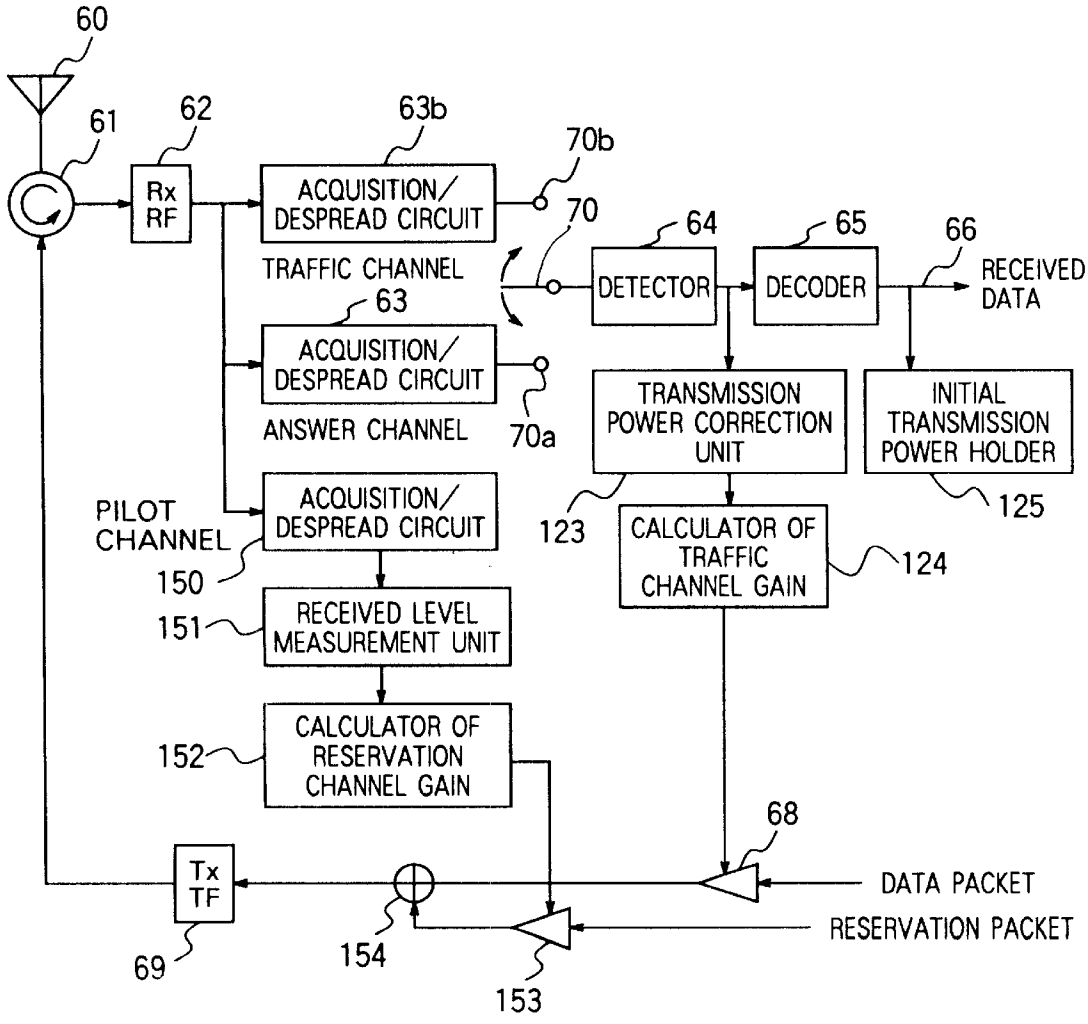
57n
59n
56n
55n
DOWNLINK TRAFFIC CHANNEL n

FIG. 11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63b
70b
Rx RF
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TRAFFIC CHANNEL
70
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65
66
DETECTOR
DECODER
RECEIVED DATA
63
ACQUISITION/ DESPREAD CIRCUIT
ANSWER CHANNEL
70a
TRANSMISSION POWER CORRECTION UNIT
INITIAL TRANSMISSION POWER HOLDER
125
123
PILOT CHANNEL
ACQUISITION/ DESPREAD CIRCUIT
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CALCULATOR OF TRAFFIC CHANNEL GAIN
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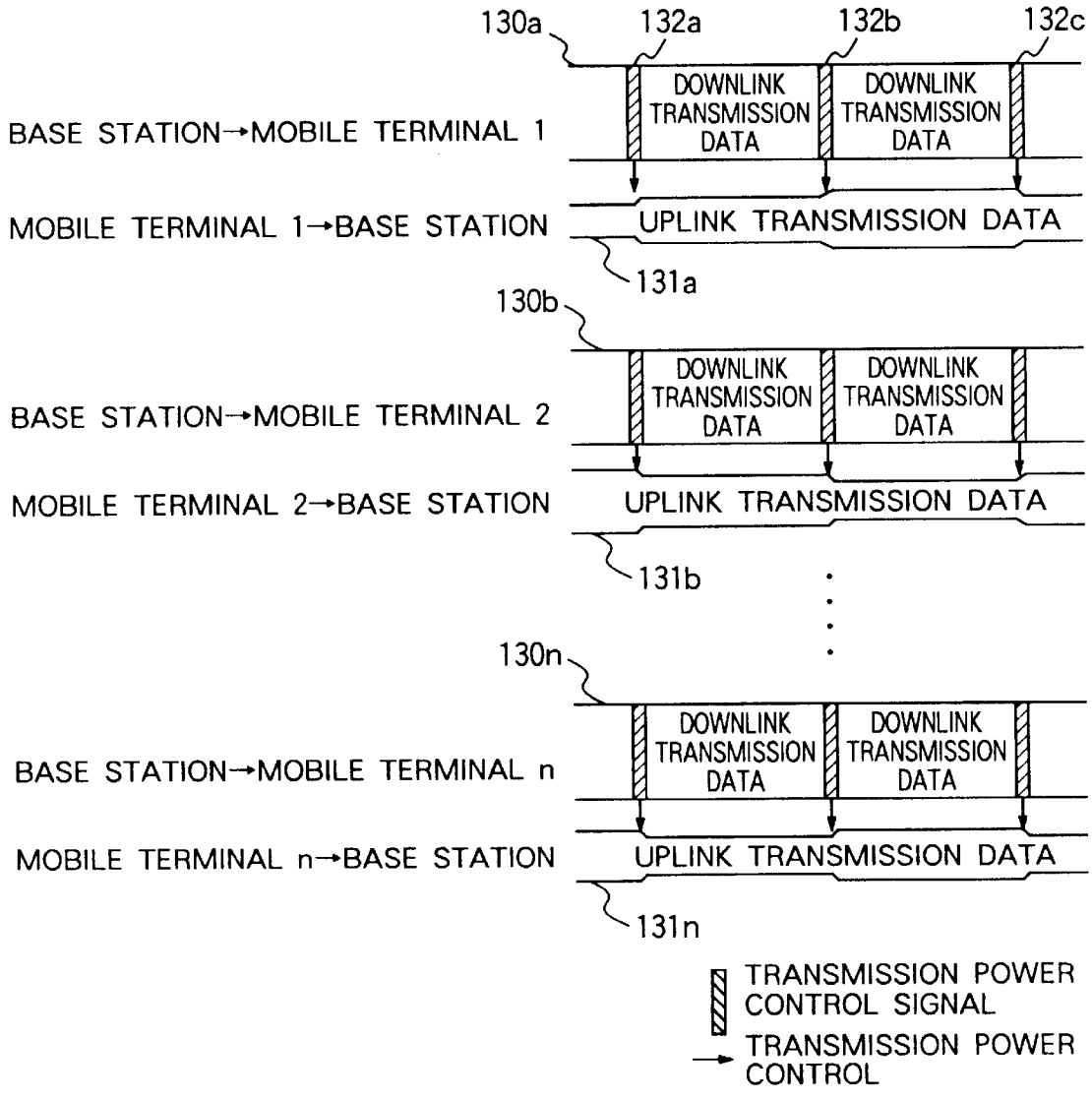
151
RECEIVED LEVEL MEASUREMENT UNIT
152
CALCULATOR OF RESERVATION CHANNEL GAIN
68
Tx TF
DATA PACKET
RESERVATION PACKET
69
154
153

FIG. 12


130a
132a
132b
132c
DOWNLINK TRANSMISSION DATA
DOWNLINK TRANSMISSION DATA
BASE STATION→MOBILE TERMINAL 1
MOBILE TERMINAL 1→BASE STATION
UPLINK TRANSMISSION DATA
131a
130b
DOWNLINK TRANSMISSION DATA
DOWNLINK TRANSMISSION DATA
BASE STATION→MOBILE TERMINAL 2
MOBILE TERMINAL 2→BASE STATION
UPLINK TRANSMISSION DATA
131b
130n
DOWNLINK TRANSMISSION DATA
DOWNLINK TRANSMISSION DATA
BASE STATION→MOBILE TERMINAL n
MOBILE TERMINAL n→BASE STATION
UPLINK TRANSMISSION DATA
131n
TRANSMISSION POWER CONTROL SIGNAL
TRANSMISSION POWER CONTROL

CDMA COMMUNICATION SYSTEM AND ITS TRANSMISSION POWER CONTROL METHOD

BACKGROUND OF THE INVENTION

The present invention relates to a code division multiple access mobile communication system and its transmission power control method. More particularly, the present invention relates to a packet communication system and its transmission power control method using reservation based access control.

In a CDMA method, a plurality of mobile terminals share the same frequency band to communicate with a single base station. Therefore, for example, if mobile terminals A and B transmit modulated signal waves to the base station, the signal (not desired to be received) transmitted by the mobile terminal B interferes with the signal (desired to be received) transmitted by the mobile terminal A, and the communication of the mobile terminal A with the base station is obstructed. The degree of interference depends on the received level of a signal (not desired to be received) at the base station. If the degree of interference becomes large to some level or more, communication between the mobile terminal and base station becomes impossible.

If the transmission power of each mobile terminal can be controlled to always limit the signal level received at the base station to a minimum necessary reception power, it becomes possible to maximize the number of channels capable of being communicated by the base station. The more the transmission power shifts from the minimum necessary reception power, the less the number of channels capable of being communicated by the base station.

As transmission power control techniques of CDMA mobile communication, an IS-95 transmission power control method is known described in TIA/EIA/IS-95 which is a standard system of digital cellular phones adopted in North America. The IS-95 transmission power control method will be described in the following.

Since two way communication is essential for cellular phones, a pair of an uplink traffic channel and a downlink traffic channel is used for the communication between the base station and a mobile terminal. The uplink traffic channel is a channel for transmitting data from a mobile terminal to the base station, and a downlink traffic channel is a channel for transmitting data from the base station to the mobile terminal.

The base station measures the reception power of data transmitted from each mobile terminal and generates a transmission power control signal in accordance with the measured reception power. If the reception power of data is larger than a target reception power, the base station generates a transmission power control signal "1" for this mobile station. Conversely if the reception power of data is smaller than the target reception power, the base station generates a transmission power control signal "0" for this mobile station. The generated transmission power control signal is inserted into data to be transmitted from the base station to a mobile terminal, and the transmission data with the transmission power control signal is transmitted to the mobile terminal. The mobile terminal controls to reduce the transmission power if the received transmission power control signal is "1", and to increase it if "0".

This transmission power control will be described specifically with reference to FIG. **12**. Each mobile terminal **1** to n and the base station communicate with each other by using a pair of an uplink traffic channel and a downlink traffic channel. The upper row of each pair represents transmission data of the downlink traffic channel, and the lower row represents transmission data of the uplink traffic channel. The width of transmission data, particularly uplink transmission data, is drawn to correspond to a reception power of the uplink data at the base station.

When the base station communicates with the mobile terminal **1**, it inserts transmission power control signals **132***a*, **132***b*, **132***c*, . . . into a downlink traffic channel **130***a* to the mobile terminal **1**. The mobile terminal **1** changes its transmission power of the uplink transmission data in accordance with the transmission power control signal obtained from the received channel **130***a*. As above, the transmission power control of the mobile terminal **1** is performed by using the downlink traffic channel **130***a*. Similar transmission power control is performed also for other mobile terminals **2** to n.

SUMMARY OF THE INVENTION

With advancement of mobile communication techniques, needs of not only a voice communication function (cellular phone) but also a data communication function are becoming large.

For one way communication typical to data communication, CDMA packet communication systems have been proposed from the viewpoint of efficiently using channels. One proposal of such CDMA packet communication systems is described in "Development on CDMA Packet Mobile Communication System" by Yano, Uta, Hasegawa, and Doi, Communication Society Meeting, the Institute of Electronics, Information and Communication Engineers, B-389 (1996).

Voice communication is two way communication using uplink and downlink traffic channels, whereas data communication is one way communication using only one of uplink and downlink traffic channels. In such one way communication, a conventional transmission power control method for cellular phones cannot be adopted because this method is established on the assumption that there is a pair of uplink and downlink traffic channels.

If a paired downlink channel is provided only for the transmission power control of the uplink traffic channel, one downlink traffic channel is occupied by the transmission power control of only the uplink traffic channel. The use efficiency of traffic channels is lowered.

To solve this problem, the invention provides a CDMA packet data communication system in which a base station controls the transmission power of each of a plurality of mobile terminals by using a single downlink traffic channel common for all mobile stations.

The base station measures the received level of data transmitted from each mobile terminal at each channel, and generates a transmission power control signal of each channel in accordance with the measured reception level. The generated transmission power control signals are collected together into a format predetermined for the system, and transmitted to all mobile terminals by using the common channel shared by the mobile terminals.

Each mobile terminal derives the transmission power control signal of the uplink traffic channel used by the terminal, from the collected transmission power control signals transmitted from the base station, and transmits data at the transmission power changed in accordance with the derived transmission power control signal.

These and other objects, features and advantages of the present invention will become more apparent in view of the

following detailed description of the preferred embodiments in conjunction with accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram showing the structure of a mobile communication network.

FIG. **2** is a diagram illustrating a packet data communication system using reservation based access control.

FIG. **3** is a diagram showing a first example of the structure of a base station embodying transmission power control of the present invention.

FIG. **4** is a diagram showing the structure of an answer packet.

FIG. **5** is a diagram showing the structure of a unit for measuring a received level of a traffic channel.

FIG. **6** is a diagram showing the structure of a unit for generating a transmission power control signal of a traffic channel.

FIG. **7** is a diagram illustrating insertion of a transmission power control signal between answer packets.

FIG. **8** is a diagram showing a first example of the structure of a mobile terminal embodying the transmission power control of the invention.

FIG. **9** is a diagram illustrating a transmission power control state of an uplink traffic channel realized by the operations of a base station and mobile terminals according to the present invention.

FIG. **10** is a diagram showing a second example of the structure of a base station embodying the transmission power control of the invention.

FIG. **11** is a diagram showing a second example of the structure of a mobile terminal embodying the transmission power control of the invention.

FIG. **12** is a diagram illustrating an uplink traffic channel transmission power control method of a conventional portable telephone system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows the structure of a mobile communication network applied to the present invention. A public switched telephone network (PSTN) **200** is connected with a fixed terminal **201** such as a telephone and a mobile communication network **202**. The mobile communication network **202** is connected with a plurality of base stations **203***a*, **203***b*, . . . Each base station **203** communicates with mobile terminals **204***a*, **204***b*, . . . in its service area (cell) via radio channels **205**.

In the following, the invention will be detailed by applying it to a CDMA packet communication system using reservation based access control shown in FIG. **2**.

In the CDMA packet communication system using reservation based access control, channels shared by a plurality of mobile terminals in the service area include a reservation channel **1** (uplink channel), an answer channel **2** (downlink channel) and a pilot channel **8** (downlink channel). The pilot channel **8** is a channel used for transmitting a pilot signal **9** as a reference signal to each mobile terminal.

A mobile terminal having a data transmission request transmits a reservation packet **4** at a desired timing by using the reservation channel **1**. The base station performs scheduling of received reservation packets. The base station selects (schedules) a channel and a time slot (a time slot **7** is defined in an uplink traffic channel **3**) via which each mobile terminal can transmit data, from a plurality of uplink traffic channels **3**. In order to transmit the scheduling results to each mobile terminal, the base station generates an answer packet **5** corresponding to the reservation packet. The generated answer packet **5** is transmitted to the corresponding mobile terminal in the area by using the answer channel **2**. The mobile terminal identifies the answer packet destined to it from received answer packets **5**, and transmits a data packet by using the uplink traffic channel and time slot designated by the base station.

In the example shown in FIG. **2**, the mobile terminal transmitted the reservation packet **4***a* receives the answer packet **5***a* transmitted to it, selectively from answer packets transmitted from the base station, and transmits a data packet **6***a* by using the time slot **7***a* of the traffic channel **3***a* designated in the received answer packet **5***a*.

With reference to FIGS. **3** to **9**, a first embodiment will be described which realizes a method of controlling the transmission power of an uplink channel.

FIG. **3** shows an example of the structure of a base station. A signal received by an antenna **30** is input via a circulator **31** to a reception radio module **32**. The reception radio module **32** performs a high/middle frequency reception process to demodulate a signal in a carrier frequency band into a baseband signal. Since the received signal has a plurality of multiplexed channel signals, it is input to an acquisition/despread circuit (**33**, **42***a*–**42***n*) to be spectrum despread.

A reservation channel output from the reservation channel acquisition/despread circuit **33** is supplied via a signal line **50** to a detector **35** whereat it is detected and then supplied to a decoder **36** whereat an error correction decode process such as Viterbi decoding is performed. A packet interpretation unit **37** interprets the decoded reservation packet to obtain a terminal ID of the mobile terminal which transmitted the reservation packet and the reservation contents such as transmission data, and transfers the reservation contents to an answer packet generator unit **38**.

The reservation packet is also input via a signal line **51** to a unit **39** for measuring the received level of the reservation channel. This unit **39** measures a signal to noise power ratio (SN ratio) of the reservation packet. The measurement result of the received level is compared with a reference reception level by an initial transmission power control signal generator **40**. In accordance with this comparison result, a transmission power control signal is generated which designates a transmission power when the mobile terminal starts transmitting a data packet. The generated transmission power control signal is input to an answer packet generator **38**.

In accordance with the reservation contents interpreted by the packet interpretation unit **37** and the transmission power control signal generated by the initial transmission power control signal generator **40**, the answer packet generator **38** generates an answer packet. An example of the structure of an answer packet is shown in FIG. **4**. A mobile terminal ID is an ID of a mobile terminal which transmitted a reservation packet. This ID is used as a destination of the answer packet. An allocated channel **101** and an allocated slot number **102** indicate an uplink traffic channel and a time slot to be used by the mobile terminal and are designated by the answer packet generator **38**. An initial transmission power **103** indicates a transmission power when the mobile terminal starts transmitting data and is designated by the transmission power control signal input from the initial transmission power control signal generator **40**. This initial transmission

power control signal may designate an increase/decrease relative to the transmission power when the reservation packet was transmitted, or may be an absolute value (increased/decreased value) of the transmission power, whichever of them is determined by the system. A CRC (Cyclic Redundancy Check) **104** is a code added to the answer packet for error detection/correction.

The answer packet generated in the above manner is input to a coder **47** whereat an error correction coding such as convolutional coding is performed. The coded answer packet is input to a unit **41** for inserting a traffic channel transmission power control signal.

The other acquisition/despread circuits **42***a* to **42***n* provided for a plurality of uplink traffic channels each output a data packet transmitted via each uplink traffic channel. The data packet of each channel is supplied via a signal line **52** to a detector **43***a*–**43***n* and a decoder **44***a* to **44***n* to be detected and decoded, and the reception data is output from a signal line **54**.

The data packet is also supplied via a signal line **53** to a unit **45** for measuring the received level of the traffic channel. The structure of this unit **45** is shown in FIG. **5**. The received level measurement units **45***a* to **45***n* corresponding to the uplink traffic channels **53***a* to **53***n* measure the received level such as an SN ratio.

The received level measurement result of each traffic channel is input to a traffic channel transmission power control signal generator **46**. The structure of the generator **46** is shown in FIG. **6**. Each of the transmission power control signal generators **46***a* to **46***n* provided for each uplink traffic channel compares the received level with a target reception level, and generates a transmission power control signal for making the mobile terminal renew the transmission power when it continues data transmission. Similar to the initial transmission power control signal, this renewal designation transmission power control signal is determined by the system. The generated transmission power control signal is input to the unit **41** for inserting the traffic channel transmission power control signal.

As shown in FIG. **7**, the traffic channel transmission power control signal insert unit **41** inserts a common transmission power control signal **111** generated by the traffic channel transmission power control signal generator **46** at a predetermined interval between answer packets **110** input from the answer packet generator **38**. The common transmission power control signal **111** is constituted of transmission power control signals **111***a* to **111***n* of respective traffic channels **1** to n.

In order to suppress a fluctuation of the received level of a data packet, the base station is required to perform a transmission power control of each mobile terminal at a sufficiently high occurrence frequency. The data packet is made of several tens of bits to allow information of some amount to be transmitted at the same time. In contrast, the common transmission power control signal **111** can be made of n bits assuming the same system as IS-95. As shown in FIG. **4**, the answer packet can be made sufficiently small relative to the size of a data packet. Therefore, as in this embodiment, even if the answer channel and the transmission power control channel are shared, the transmission power control can be performed at a sufficiently high occurrence frequency. If the answer packet and the common transmission power control signal are received by the same channel, the mobile terminal can use a common receiver both for the answer packet and common transmission power control signal. In this manner, the circuit scale of each mobile terminal can be made small.

It is also possible to transmit the common transmission power control signal at a transmission power larger than that of the answer packet in order to reliably perform the transmission power control.

The answer packet and common transmission power control signal are spectrum spread by a spreader **48** for answer channel. The spectrum spread answer packet and common transmission power control signal are multiplexed with other downlinks by an adder **58**, modulated from the baseband signal into a signal in the carrier frequency band by a transmission radio module **49**, and transmitted from the antenna **30** via the circulator **31**.

An example of the structure of a mobile terminal is shown in FIG. **8**.

The operation of transmitting a reservation packet from a mobile terminal will be described.

A signal received by an antenna **30** is input via a circulator **61** to a reception radio module **62**. The reception radio module **62** performs a high/middle frequency reception process to demodulate a signal in the carrier frequency band into a baseband signal. A pilot signal output from an acquisition/spread circuit **150** for a pilot channel is input to a unit **151** for measuring a received level. This unit **151** measures the received level (e.g., SN ratio) of the pilot signal. The measurement result of the received level is input to a reservation channel gain calculator **152** which determines the transmission power of a reservation packet in accordance with the received level of the pilot signal.

In the mobile communication system provided with independent pilot channels, the pilot signal is transmitted from the base station always at a constant transmission power level. Therefore, if an SN ratio of the received pilot signal is large, it is conceivable that the mobile terminal is near at the base station so that the reservation channel gain calculator **152** calculates a small gain. Conversely, if an SN ratio of the received pilot signal is small, it is conceivable that the mobile terminal is far from the base station so that the reservation channel gain calculator **152** calculates a large gain. In order to determine the transmission power of a reservation packet in the above manner, another signal different from the pilot signal may be used so long as it allows the mobile terminal to know the transmission power of the base station. For example, the pilot signal whose transmission power is determined by the system or a control signal transmitted with the transmission power value can satisfy the above conditions.

Next, an operation will be described in which a mobile terminal that transmitted a reservation packet to the base station receives an answer packet transmitted from the base station.

An answer packet output from the despread circuit **63** for an answer channel is detected with a detector and subjected to an error correction/decode process such as Viterbi decoding. With the above processes, it becomes possible to obtain the information of an allocated traffic channel and an allocated time slot contained in the answer packet. An initial transmission power holder **125** holds an initial transmission power signal contained in the answer packet, and inputs the initial transmission power signal to a data channel gain calculator **124** which calculates a gain so that a data packet can be transmitted at a transmission power designated by the initial transmission power signal. The calculated gain is set as the gain of a variable gain amplifier **68**.

The data packet transmitted from the mobile terminal is amplified by the variable gain amplifier **68** at the gain designated by the data channel gain calculator **124**. The

amplified signal is modulated from the baseband signal into a signal in the carrier frequency band by a transmission radio module **69** and transmitted from the antenna **60** via the circulator **61**.

Next, transmission power control while a mobile terminal transmits a data packet to the base station will be described.

A transmission power correction unit **123** derives the common transmission power control signal from a signal of the answer channel processed by the answer channel acquisition/despread circuit **63** and detector **64**. The transmission power correction unit **123** selects a transmission power control signal of the uplink traffic channel now in use by its mobile terminal, from the common transmission power control signal. For example, in the example shown in FIG. **7**, the mobile terminal transmitting a data packet by using the transmission channel **1** selects its transmission power control signal **111***a*. The selected transmission power control signal is input to the gain calculator **124** which calculates a gain so that a data packet can be transmitted at a transmission power designated by the transmission control signal, and thereafter renews the gain of the variable gain amplifier **68**. The amplified signal is modulated by the transmission radio module **69** from the baseband signal into a signal in the carrier frequency band, and transmitted from the antenna **60** via the circulator **61**.

FIG. **9** illustrates the state of transmission power control realized by the above operations of the base station and a mobile terminal.

The base station inserts common transmission power control signals **142***a*, **142***b*, **142***c*, . . . into a common answer channel shared by mobile terminals in the area and transits them. The common transmission power control signal **142** contains transmission power control signals for the respective traffic channels **1** to n. Each of the mobile terminals **1** to n transmitting data packets **1** to n to the base station derives the transmission power control signal of the traffic channel now in use by the mobile terminal, from the common transmission power control signals **142***a*, **142***b*, **142***c*, . . . In accordance with the derived transmission power control signal, the mobile terminal changes the transmission power of the data packet.

In the state shown in FIG. **9**, the width of a data packet is drawn to correspond to the receive level of the data packet at the base station. For example, in the uplink traffic channel **1**, the mobile terminal controls the transmission power such that the transmission powers are increased, reduced, and increased in response to the reception of the common transmission power control signals **142***a*, **142***b*, and **142***c*.

While a data packet is not transmitted by a mobile station, the transmission power control signal is neglected. The transmission power control signal is also neglected if it is received before a lapse time (called "control delay time") necessary for measuring the received level of a data packet at the base station after the mobile terminal transmitted the data packet. The reason for this is a possibility that the transmission power control information received before the lapse of the control delay time may be the transmission power control information of a data packet transmitted by another mobile terminal resulting in erroneous control to be made.

With the above operations, it becomes possible for the base station to perform transmission power control of the uplink traffic channels **1** to n by using the common control channel shared by the mobile terminals.

This first embodiment has the structure suitable for data communication, particularly for one way data communication. Two way data communication is performed in some case. In this case, the transmission power control signal may be contained in data of a downlink traffic channel. In the following, a mobile communication system of the second embodiment will be described which is suitable for two way communication and has a simple circuit structure, particularly of a mobile terminal.

FIG. **10** shows an example of the structure of a base station according to the second embodiment.

In FIG. **10**, like constituent elements to those of the base station of the first embodiment are represented by identical reference numerals. The operation of the base station when a reservation packet is received is similar to the first embodiment.

The base station operates in the manner similar to the first embodiment to decode a received data packet and obtain reception data from the signal line **54**. The unit **45** for measuring the received level of a traffic channel and the traffic channel transmission power control signal generator **46** generate transmission power control signals of respective uplink traffic channels.

In the second embodiment, if a mobile terminal transmits and receives a data packet to and from the base station by using an uplink traffic channel i and a down-link traffic channel k, the base station inputs the transmission power control signal of the uplink traffic channel i to the traffic channel transmission power control signal insert unit **59** of the downlink traffic channel k to insert the transmission power control signal into the data packet.

The operation will be detailed by taking as an example the case wherein the base station transmits a data packet by using a downlink traffic channel n to a mobile terminal which transmits a data packet to the base station by using an uplink traffic channel **1**. In this case, the transmission power control signal of the uplink traffic channel **1** generated by the traffic channel transmission power control signal generator **46** is input to a traffic channel transmission power control signal insert unit **59***n* of the downlink transmission channel n. The traffic channel transmission power control signal insert unit **59***n* inserts the transmission power control signal in the data packet. This data packet is spectrum spread by the spreader **57***n* and multiplexed with other channel signals by the adder **58**. The multiplexed signal is modulated by the transmission radio module **49** from the baseband signal into a signal of the carrier frequency band, and transmitted from the antenna **30** via the circulator **31**.

An example of a mobile terminal of the second embodiment is shown in FIG. **11**.

In FIG. **11**, like constituent elements to those of the mobile terminal of the first embodiment shown in FIG. **8** are represented by identical reference numerals. A switch **70** is connected to **70***a* to perform similar operations to the first embodiment, if the mobile terminal transmits a reservation packet, receives an answer packet transmitted from the base station, or only transmits a data packet to the base station (one way communication).

Next, an operation (two way communication) will be described in which a mobile terminal transmits and receives a data packet to and from the base station. In this case, the switch **10** is turned to the **70***b* side.

A data packet is received via the antenna **60**, circulator **61** and reception radio module **62**, and subjected to a reception process by the traffic channel acquisition/despread circuit **63***b* and detector **64**. The data packet output from the detector is subjected to error correction/decoding by the decoder **65** to obtain reception data from the signal line **66**.

The data packet is also input to the transmission power correction unit **123** which derives the transmission power control signal inserted in the data packet and inputs it to the traffic channel gain calculator **124**. The traffic channel gain calculator **124** calculates a gain of the variable gain amplifier **68** to renew the gain, similar to the first embodiment.

With the base station and mobile terminals having the above structures and operating in the above manner, it becomes possible for a mobile terminal to perform transmission/reception of a data packet to/from the base station and reception of transmission power control by the base station, by using either the answer channel or traffic channel. Therefore, it is sufficient if only the mobile terminal has one set of a detector and a decoder, and so the circuit scale of the mobile terminal can be prevented from becoming large.

In the above embodiments, the invention has been applied to a mobile communication system of a reservation based access control scheme in which a base station transmits a transmission power control signal to each mobile terminal by using an answer channel. The invention is also applicable to a channel other than the answer channel if it is a common channel shared by mobile terminals. Namely, if a system uses a common channel shared by mobile terminals, the base station can perform transmission power control of a plurality of mobile terminals by transmitting transmission power control signals via the single common channel. Obviously, a channel dedicated to transmission power control may be provided to perform transmission power control of mobile terminals by transmitting transmission power control signals from the base station by using this dedicated channel.

While the present invention has been described above in conjunction with the preferred embodiments, one of ordinary skill in the art would be enabled by this disclosure to make various modifications to this embodiment and still be within the scope nd spirit of the invention as defined in the appended claims.

What is claimed is:

1. A transmission power control method for a CDMA communication system, comprising: a base station and a plurality of mobile terminals

performing communication by CDMA;

a plurality of said mobile terminals transmitting over uplink traffic channels to said base station;

said base station measuring the reception level of a signal transmitted from each of said plurality of mobile terminals, generating a transmission control signal in accordance with the reception level and a common transmission power control signal containing said transmission power control signals of said plurality of mobile terminals; spreading said common transmission power control signal with a spreader, and transmitting said spread common transmission power control signal through a common channel shared by said mobile terminals;

each of said plurality of mobile terminals receiving said common transmission power control signal, deriving a corresponding one of said transmission power control signals from said common transmission power control signal, and controlling the transmission power of a signal to be transmitted to said base station in accordance with said derived transmission power control signal.

2. A transmission power control method according to claim **1**, wherein said transmission power control signal is a signal indicating an increase/decrease of said transmission power and obtained through comparison between said reception level and a predetermined reference reception level.

3. A transmission power control method for a CDMA communication system which performs communication between a base station and a plurality of mobile terminals by CDMA, wherein:

said plurality of channels includes first channels allocated to said mobile terminals for transmitting a data packet to said base station and a second channel used by said base station, said second channel being shared by said plurality of mobile terminals;

said base station measures the reception level of a signal received at each of said first channels, generates a transmission power control signal in accordance with the reception levels and a common transmission power control signal containing said transmission power control signals of said plurality of mobile terminals, spreads said common transmission power control signal with a spreader, and transmits said spread common transmission power control signal through a said second channel shared by said mobile terminals; and

each of said plurality of mobile terminals receives said transmission power control signal destined thereto at said second channel, and controls the transmission power of a signal to be transmitted via a corresponding one of said first channels in accordance with said received transmission power control signal.

4. A transmission power control method according to claim **3**, wherein each of said first channels is allocated to each of said plurality of mobile terminals, said base station comprises third channels for transmitting data packets to said plurality of mobile terminals, and either a pair of said first channel and said third channel or only said first channel is allocated by said base station to said plurality of mobile terminals.

5. A transmission power control method for communication system which performs communication between a base station and a plurality of mobile terminals by CDMA, wherein:

a plurality of said mobile terminals transmit over uplink traffic channels to said base station;

said base station measures the reception level of a signal transmitted from each of said plurality of mobile terminals, generates a transmission power control signal in accordance with the reception level and a common transmission power control signal containing said transmission power control signals of mobile terminals performing one way communication, said common transmission power control signal is spread with a spreader, and said base station transmits said spread common transmission power control signal through a common channel shared by said mobile terminals and transmits a transmission signal containing a transmission power control signal of a mobile station performing two way communication thereto; and

each of said plurality of mobile terminals receives said common transmission power control signal or said transmission signal, derives a corresponding one of said transmission power control signals destined thereto from said common transmission power control signal or from said transmission signal, and controls the transmission power of a signal to be transmitted to said base station in accordance with said derived transmission power control signal.

6. A CDMA communication system for performing CDMA communication between a base station and a plurality of mobile terminals via a plurality of channels, wherein:

said plurality of channels include uplink traffic channels for transmitting a data packet from each mobile terminal to said base station, a reservation channel for transmitting a reservation packet representative of a traffic channel allocation request from each mobile terminals to said base station, and an answer channel for transmitting an answer packet indicating an uplink traffic channel via which a data packet is transmitted from said base station to each mobile terminal; and

a spreader that spreads a common transmission power control signal and transmitting said spread common transmission power control signal via said answer channel, said common transmission power control signal containing transmission power control signals of said uplink traffic channels.

7. A spectrum spreading communication system according to claim **6**, wherein:

said answer packet contains an ID of a corresponding mobile terminal which transmitted said reservation packet, information of said uplink traffic channel allocated by said base station, and initial transmission power control information indicating a transmission power when said data packet starts being transmitted; and

said initial transmission power control information is generated in accordance with a reception power of said reservation packet at said base station.

8. A spectrum spreading communication system according to claim **6**, wherein said common transmission power control signal is inserted in said answer channel at a predetermined interval.

9. A base station for communicating with a plurality of mobile terminals by CDMA, comprising:

a reception circuit for receiving a data packet transmitted from each of said plurality of mobile terminals, said plurality of said mobile terminals transmitting over uplink traffic channels to said base station;

a unit for measuring the reception level of said received data packet;

a generator for generating a transmission power control signal in accordance with said measured reception level of said data packet and a common transmission power control signal containing said generated transmission power control signals of said plurality of mobile terminals;

a spreader that spreads said common transmission power control signal; and

a transmission circuit for transmitting said spread common transmission power control signal through a common channel shared by said plurality of mobile terminals.

10. A base station according to claim **9** wherein said reception circuit includes an acquisition/despread circuit for demodulating a spectrum spread signal, and said transmission circuit includes a spreader for spectrum spreading said common transmission power control signal.

11. A base station for communicating with a plurality of mobile terminals by CDMA, comprising:

a reception circuit for receiving a data packet transmitted from each of said plurality of mobile terminals, said plurality of said mobile terminals transmitting over uplink traffic channels to said base station;

a unit for measuring the reception level of said received data packet;

a generator for generating a transmission power control signal in accordance with said measured reception level of said data packet and a common transmission power control signal containing said generated transmission power control signals of said plurality of mobile terminals;

a spreader that spreads said common transmission power control signal; and

a transmission circuit for transmitting said spread common transmission power control signal through a common channel shared by said plurality of mobile terminals, as part of control information.

12. A base station for communicating with a plurality of mobile terminals by CDMA, comprising:

a first reception circuit for receiving a reservation packet representative of a transmission request for a data packet to be transmitted from each of said plurality of mobile terminals, said plurality of said mobile terminals transmitting over uplink traffic channels to said base station;

second reception circuits for receiving data packets transmitted from said plurality of mobile terminals;

a unit for measuring the reception level of said received data packet;

a traffic channel transmission power control signal generator for generating a transmission power control signal in accordance with said measured reception level of said data packet and a common transmission power control signal containing said generated transmission power control signals to be transmitted to said plurality of mobile terminals;

a spreader that spreads said common transmission power control signal; and

a transmission circuit for transmitting said spread common transmission power control signal through a common channel shared by said plurality of mobile terminals.

13. A base station according to claim **12**, wherein said transmission circuit transmits an answer packet indicating a traffic channel via which each mobile terminal transmits said data packet, said answer packet being generated after the interpretation of said reservation packet received by said first reception circuit.

14. A base station according to claim **13**, further comprising:

a unit for measuring the reception level of said received reservation packet; and

a reservation channel transmission power control signal generator for generating an initial transmission power control signal in accordance with said measured reception level of said reservation packet,

wherein said initial transmission power control signal is contained in said answer packet.

15. A mobile terminal for communicating with a base station by CDMA, comprising:

a reception circuit for receiving a common transmission power control signal that is spread by a spreader and transmitted through a common channel shared by a plurality of said mobile terminals from said base station, said common transmission power control signal containing transmission power control signals of said plurality of mobile terminals transmitting over uplink traffic channels to said base station;

a calculator for calculating a gain in accordance with a transmission power control signal destined to the mobile terminal and derived from said spread common transmission power control signal; and

a transmission circuit for transmitting a data packet at a transmission power corresponding to said calculated gain.

16. A mobile terminal for communicating with a base station by CDMA, comprising:

a first reception circuit for receiving a common transmission power control signal through a common channel shared by a plurality of said mobile terminals that is spread by a spreader and transmitted from said base station, said common transmission power control signal containing transmission power control signals of said plurality of mobile terminals, and for receiving an answer packet transmitted from said base station, said answer packet indicating a traffic channel via which the mobile terminal transmits a data packet;

a calculator for calculating a gain in accordance with a transmission power control signal destined to the mobile terminal and derived from said common transmission power control signal; and

a transmission circuit for transmitting said data packet at a transmission power corresponding to said calculated gain via said traffic channel designated by said answer packet.

17. A mobile terminal according to claim **16**, wherein said answer packet includes an initial transmission power control signal, said calculator calculates a gain to be used at the start of transmission in accordance with said initial transmission power control signal, and said transmission circuit starts transmitting said data packet at a transmission power corresponding to said calculated gain to be used at the start of transmission.

18. A mobile terminals according to claim **16**, further comprising:

a second reception circuit for receiving a control signal transmitted from said base station, a transmission power of said control signal being predetermined;

a unit for measuring the reception level of said control signal; and

a reservation channel gain calculator for calculating a reservation packet gain in accordance with the reception level of said control signal measured by the unit, said reservation packet gain being used for transmitting a reservation packet representative of a transmission request for said data packet,

wherein said transmission circuit transmits said reservation packet at a transmission power corresponding to said reservation packet gain.

19. A mobile terminal for communicating with a base station by spectrum spreading, comprising:

a first reception circuit for receiving a common transmission power control signal transmitted from said base station, said common transmission power control signal containing transmission power control signals of a plurality of mobile terminals, and for receiving an answer packet transmitted from said base station, said answer packet indicating a traffic channel via which the mobile terminal transmits a data packet;

a second reception circuit for receiving said data packet containing said transmission power control signal transmitted from said base station;

a switch for switching a connection to a gain calculator between said first reception circuit and said second reception circuit; and

a transmission circuit for transmitting said data packet at a transmission power corresponding to the gain calculated by said gain calculator via the traffic channel designated by said answer packet,

wherein said gain calculator calculates the gain in accordance with said common transmission power control signal or said transmission power control signal derived from said data packet.

20. A mobile terminal according to claim **19**, wherein said switch connects said first reception circuit to said gain calculator while the mobile terminal performs one way communication, and connects said second reception circuit to said gain calculator while the mobile terminal performs two way communication.

21. A mobile terminal according to claim **19**, wherein said answer packet includes an initial transmission power control signal, said gain calculator calculated a gain to be used for the start of transmission in accordance with said initial transmission power control signal, and said transmission circuit starts transmitting said data packet at a transmission power corresponding to said calculated gain to be used for the start of transmission.

22. A mobile terminal according to claim **19**, further comprising:

a second reception circuit for receiving a control signal transmitted from said base station, a transmission power of said control signal being predetermined;

a unit for measuring the reception level of said control signal; and

a reservation channel gain calculator for calculating a reservation packet gain in accordance with the reception level of said control signal measured by the unit, said reservation packet gain being used for transmitting a reservation packet representative of a transmission request for said data packet,

wherein said transmission circuit transmits said reservation packet at a transmission power corresponding to said reservation packet gain.

23. A transmission power control method for a CDMA communication system which performs communication between a base station and a plurality of mobile terminals by CDMA, wherein:

a plurality of said mobile terminals transmit over uplink traffic channels to said base station;

said base station spreading a common transmission power control signal with a spreader, and transmitting said spread common transmission power control signal through a common channel shared by said mobile terminals; said common transmission power control signal containing transmission power control signals of said plurality of mobile terminals; and

each of said plurality of mobile terminals receives said common transmission power control signal, derives a corresponding one of said transmission power control signals destined thereto from said common transmission power control signal, and controls the transmission power of a signal to be transmitted to said base station in accordance with said derived transmission power control signal.

24. A transmission power control method for a CDMA communication system which performs communication between a base station and a plurality of mobile terminals by spectrum spreading, wherein:

a plurality of said mobile terminals transmit over uplink traffic channels to said base station;

said base station spreads a common transmission power control signal with a spreader, and transmits said com-

mon transmission power control signal through a common channel shared by said mobile terminals; said common transmission power control signal containing transmission power control signals of mobile terminals performing one way communication, and said base station transmits a transmission signal containing a transmission power control signal of a mobile station performing two way communication thereto; and

each of said plurality of mobile terminals receives said common transmission power control signal or said transmission signal, derives a corresponding one of said transmission power control signals destined thereto from said common transmission power control signal or from said transmission signal, and controls the transmission power of a signal to be transmitted to said base station in accordance with said derived transmission power control signal.

25. A base station for communicating with a plurality of mobile terminals by CDMA, comprising:

a plurality of said mobile terminals transmit over uplink traffic channels to said base station;

a generator for generating a transmission power control signal and a common transmission power control signal containing said generated transmission power control signals of said plurality of mobile terminals; and

a spreader for spreading said common transmission power control signal;

a transmission circuit for transmitting said spread common transmission power control signal to said plurality of mobile terminals.

* * * * *

EXHIBIT B

US006920124B1

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Lappe et al.

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(45) **Date of Patent: Jul. 19, 2005**

(54) **METHOD FOR TRANSMITTING DIGITAL USEFUL DATA**

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(58) **Field of Search** 370/315, 316, 370/322, 326, 328, 329, 336, 342, 349, 337, 208, 252, 433, 503, 524; 714/708, 752, 799; 455/435.1, 426.1; 340/825.49

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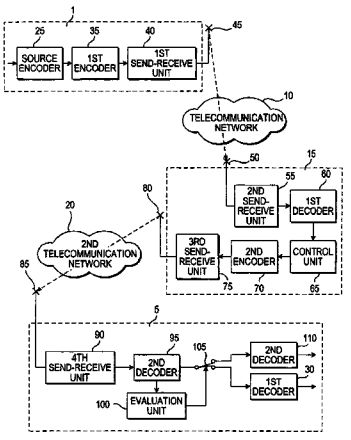
(57) **ABSTRACT**

The method for transmitting useful digital data from a first **(1)** to a second mobile station **(5)** saves computing costs and prevent data loss. In this method for transmission in a first network **(10)**, the first station **(1)** source encodes useful data in a first step and then channel encodes the source encoded useful data in a second step. The encoded useful data are transmitted as a first bit stream to an intermediary station **(15)** via a transmission channel of the first network **(10)**. The encoded useful data in the first bit stream are channel decoded by the intermediary station **(15)**. For transmission in a second network **(20)**, the useful data are again channel encoded by the intermediary station **(15)** and are transmitted to a second mobile station **(5)** via a transmission channel of the second network **(20)**. Signalization data containing information regarding the encoding in the first step are transmitted from the intermediary station **(15)** to the second mobile station **(5)**. The useful data coded in the second step are channel decoded by the second mobile station **(5)**. The resulting channel decoded useful data are then source decoded by the second mobile station **(5)** according to signalization data received by the second mobile station **(5)**.

15 Claims, 1 Drawing Sheet



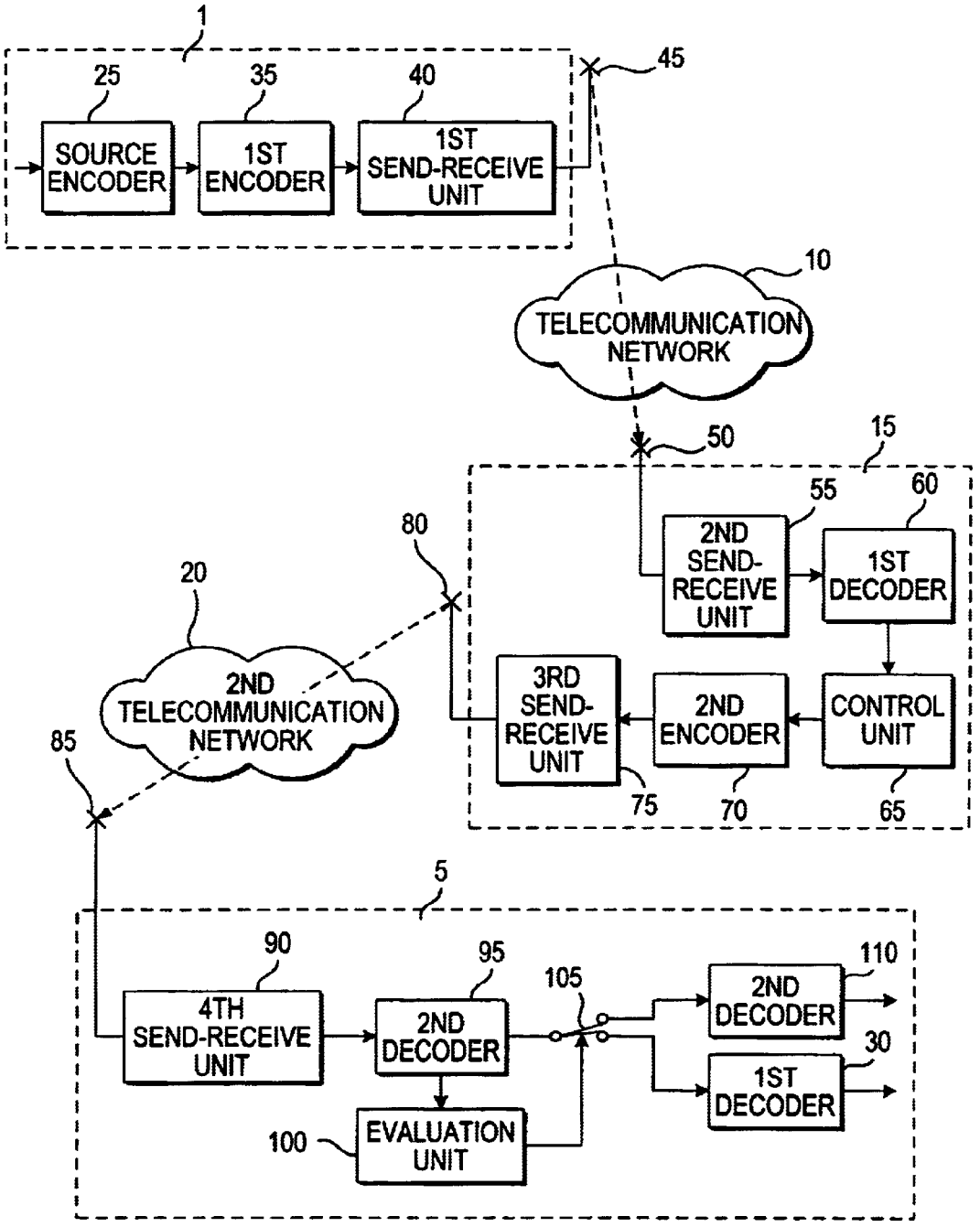

1
25
35
40
45
SOURCE ENCODER
1ST ENCODER
1ST SEND-RECEIVE UNIT
10
TELECOMMUNICATION NETWORK
50
15
55
60
2ND SEND-RECEIVE UNIT
1ST DECODER
80
20
2ND TELECOMMUNICATION NETWORK
3RD SEND-RECEIVE UNIT
2ND ENCODER
CONTROL UNIT
85
75
70
65
5
90
95
105
110
4TH SEND-RECEIVE UNIT
2ND DECODER
2ND DECODER
30
1ST DECODER
100
EVALUATION UNIT

FIG. 1

METHOD FOR TRANSMITTING DIGITAL USEFUL DATA

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a method for transmitting useful digital data from a first mobile station to a second mobile station.

2. Prior Art

Method for transmitting useful digital data from a first mobile station to a second mobile station are already known and are embodied for voice transmission, for example, in accordance with the GSM standard (Global System for Mobile Communications).

EP 0 849 965 A1 has disclosed a telephone device, which can telephone in a particularly advantageous manner in enclosed spaces via both an existing mobile radio network and a fixed telecommunication network with the aid of a dual-mode base station. The dual-mode base station, which can also be referred to as a twin station, has a DECT charging station and a DCS/GSM charging station with a voice interface. By plugging the DCS/GSM mobile station into the dual-mode base station, the mobile station is given the ability to receive mobile radio signals. These mobile radio signals are then converted into DECT signals. The connection to the DECT mobile phone is then established via a DECT antenna. In a similar manner, the PSDN/ISDN signals are also converted and emitted via DECT.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved method of transmitting useful digital data between mobile stations.

The method according to the invention has advantages has the following advantageous features: that for the transmission in a first telecommunication network, the first mobile station encodes, preferably source encodes, the useful data in a first step and encodes, preferably channel encodes, the useful data in a second step, that the useful data encoded in the first and second steps are transmitted in the form of a first bit stream to an intermediary station via a transmission channel of the first telecommunication network, in particular via at least one third telecommunication network, that the useful data of the first bit stream are decoded, preferably channel decoded, by the intermediary station in the second step, that for the transmission in a second telecommunication network, the useful data are encoded, preferably channel encoded, by the intermediary station in the second step, that the useful data are transmitted to the second mobile station via a transmission channel of the second telecommunication network, that signalization data are transmitted from the intermediary station to the second mobile station, wherein the signalization data contain information regarding the type of encoding of the useful data in the first step, that the useful data are decoded, preferably channel decoded, by the second mobile station in the second step, and that the useful data decoded by the second mobile station in the second step are decoded, preferably source decoded, by the second mobile station in the first step, depending on the signalization data received by the second mobile station. In this manner, the useful data received in the intermediary station are only decoded in the second step, but not in the first step. Then an encoding in the first step for the transmission of the useful data in the second telecommunication network is not necessary. A decoding in the first step of the useful data received in the second mobile station can then take place through the evaluation of the signalization data transmitted along with the useful data by the intermediary station. A transcoding between different codes for the encoding in the first step for transmission in the respective telecommunication network can consequently be avoided, which can save computing costs and prevent the lost of useful data that occurs during a transcoding.

Advantageous improvements and updates of the method disclosed in the main claim are possible through the measures taken in the dependent claims.

It is particularly advantageous that the useful data in the first telecommunication network are transmitted in accordance with a first mobile radio standard, in particular in accordance with the GSM standard (Global System for Mobile Communications), encoded, preferably source encoded and channel encoded, in the first and second step, that the useful data in the second telecommunication network are encoded, preferably channel encoded, in the second step and are transmitted in accordance with a second mobile radio standard, in particular in accordance with the UMTS standard (Universal Mobile Telecommunications System), together with the signalization data, which include information regarding the encoding of the useful data in the first step in accordance with the first mobile radio standard, and that the useful data, which are decoded, preferably channel decoded, by the second mobile station in the second step, are decoded, preferably source decoded, by the second mobile station in accordance with the first mobile radio standard after the evaluation of the signalization data. In this manner, useful data can be transmitted between mobile stations with a respective air interface embodied according to a different mobile radio standard without which a transcoding of the useful data with regard to the code for the encoding in the first step would be required, provided that the second mobile station which receives the useful data is in a position to execute a decoding of the received useful data in the first step in accordance with the first mobile radio standard.

DRAWING

An exemplary embodiment of the invention is shown in the drawing and will be described in detail in the subsequent description.

The sole FIGURE is a block circuit diagram for the transmission of useful data from a first mobile station. to a second mobile station via an intermediary station by means of different telecommunication networks.

DESCRIPTION OF THE EXEMPLARY EMBODIMENT

In the FIGURE, the reference numeral **1** indicates a first mobile station, which is embodied in accordance with a first mobile radio standard. The first mobile radio standard can, for example, be the GSM standard (Global System for Mobile Communications). The first mobile station **1** will be referred to below as a GSM mobile station. The FIGURE shows only those functional blocks of the first mobile station **1** that are required for the description of the method according to the invention. The first mobile station **1** includes an encoder **25** embodied as a source encoder for an encoding in a first step which encoder is embodied in accordance with the first mobile radio standard, the GSM standard in the example described. By means of a first encoder **35** embodied as a channel encoder for an encoding in a second step, which encoder is likewise embodied in accordance with the first mobile radio standard, the source encoder **25** is connected to a first send-receive unit **40**, which is connected to a first send-receive antenna **45**. Radio signals can be transmitted by the first send-receive antenna **45** to a second send-receive antenna **50** of an intermediary station **15** in accordance with

the first mobile radio standard by means of a first telecommunication network **10** which is embodied as a GSM network in the exemplary embodiment described. The intermediary station **15** contains a second send-receive unit **55**, which is connected to the second send-receive antenna **50**. The second send-receive unit **55** is connected to a first decoder **60** embodied as a channel decoder for a decoding in the second step, which is connected to a control unit **65** of the intermediary station **15**. By means of a second encoder **70** embodied as a channel encoder for the encoding in the second step, the control unit **65** is connected to a third send-receive unit **75** of the intermediary station **15**, which is connected to a third send-receive antenna **80**. The third send-receive antenna **80** transmits radio signals to a second mobile station **5** in accordance with a second mobile radio standard by means of a second telecommunication network **20**. The second mobile radio standard can, for example, be the UMTS standard (Universal Mobile Telecommunications System). For the intermediary station **15** as well, the FIGURE shows only the functional blocks required for the description of the method according to the invention. The same is true for the second mobile station **5**, which receives the radio signals from the intermediary station **15** by means of a fourth send-receive antenna **85**. The second mobile station **5** includes a fourth send-receive unit **90** which is connected to the fourth send-receive antenna **85**. The fourth send-receive unit **90** is also connected to a second decoder **95** embodied as a channel decoder for the decoding in the second step, which is connected to an evaluation unit **100**. By means of a switch **105** that can be controlled by the evaluation unit **100**, the second channel decoder **95** is connected either to a first decoder **30** embodied as a source decoder for a decoding in the first step or to a second decoder **110** embodied as a source decoder for the decoding in the first step. The first source decoder **30** is embodied in accordance with the first mobile radio standard and the second source decoder **110** is embodied in accordance with the second mobile radio standard. In the following, the UMTS standard has been selected by way of example for the second mobile radio standard so that the second mobile station **5** is at least partially embodied as a GSM/UMTS mobile station. The source encoder **25** is supplied with useful digital data, which can be video data, audio data, text data, voice data, and/or any other data. In the following, the transmission of useful data between the first mobile station **1** and the second mobile station **5** will be described by way of example in conjunction with the transmission of voice data. The source encoder **25** is then embodied as a voice encoder according to the first mobile radio standard, the GSM standard in this example. As a result, the voice encoder **25** can be based on the GSM standard ITU-T G. 729. The voice encoder **25** executes a source encoding of the useful data, which are supplied to it and are embodied as voice data, in accordance with the GSM standard. The voice data source encoded in this manner are supplied to the first channel encoder **35**, which executes a channel encoding of the voice data, for example a folding encoding and a block encoding, in accordance with the GSM standard. The voice data source encoded and channel encoded in this manner are then transmitted via the first send-receive unit **40** from the first send-receive antenna **45** to the intermediary station **15** in the form of a first bit stream by means of a first transmission channel of the first telecommunication network **10** embodied as a GSM network. The bit stream received by the second send-receive antenna **50** is then supplied to the first channel decoder **60** via the second send-receive unit **55**. The first send-receive antenna **45**, together with the second send-receive antenna **50**, thereby constitutes a so-called GSM air interface. The source encoded and channel encoded voice data of the first bit stream are then channel decoded in the first channel decoder **60** in accordance with the GSM standard. The voice data channel decoded in this manner are then source encoded again and are supplied to the control unit **65**. Along with the voice data, the first mobile station **1** has also transmitted call identification data to the intermediary station **15**, which identify the second mobile station **5** as the targeted subscriber for the voice data to be transmitted. These call identification data have been generated, for example, in a control unit, not shown in the drawing, of the first mobile station **1**, are channel encoded by the first channel encoder **35**, and are transmitted along with the voice data to the intermediary station **15** in the first bit stream. Together with the voice data, these call identification data are then also channel decoded by the first channel decoder **60** and likewise supplied to the control unit **65**. The call information data can also be transmitted from the first mobile station **1** to the intermediary station **15** singly or multiply via a separate control channel, separate from the voice data and include the telephone number of the second mobile station **5** as the target station. The control unit **65** detects these call identification data and based on these data, designates the second mobile station **5** as the target subscriber for the voice data to be transmitted from the first mobile station **1**. In this connection, it is known in the control unit **65** that in order to transmit the voice data from the intermediary station **15** to the second mobile station **5**, a transmission channel must be established in the second telecommunication network **20**. The transmission of voice data in the second telecommunication network **20** occurs in accordance with the second mobile radio standard, the UMTS standard in the exemplary embodiment described. The third send-receive antenna **80** and the fourth send-receive antenna **85** consequently constitute a UMTS air interface. It is also known in the control unit **65** that the intermediary station **15** can decode both useful signals source encoded in accordance with the GSM standard and useful signals source encoded in accordance with the UMTS standard. The control unit **65** therefore selects a data transmission service in accordance with the UMTS standard in which the voice data, which have been channel decoded but are still source encoded in accordance with the GSM standard, are embedded in a second bit stream in accordance with the UMTS standard.

The intermediary station **15** can also have the potential for a source decoding of received useful data in accordance with the GSM standard. In this instance, along with the call identification data, it is useful to also transmit, for example, the telephone number of the calling first mobile station **1** to the intermediary station **15** and to forgo a source decoding of the received useful data in the intermediary station **15** depending on the detection of this telephone number in the control unit **65**.

The control unit **65** also embeds signalization data into the second bit steam, wherein the signalization data contains information regarding the type of source encoding of the useful data. The signalization data consequently indicate that the useful data in the form of voice data in the example described are source encoded according to the GSM standard. In the second channel encoder **70**, the voice data and the signalization data of the second bit stream are channel encoded according to the UMTS standard for transmission in the second telecommunication network **20**, for example likewise by means of a folding encoding and a block encoding. The third send-receive unit **75** transmits the thus channel encoded voice data and signalization data of the second bit stream to the second mobile station **5** via a transmission channel of the second telecommunication network which in this example, is embodied as a UMTS network. With the data transmission service selected by the control unit **65** in accordance with the UMTS standard, the transmission quality and the transmission data rate must be suitably selected in order to transmit the voice data which is

still source encoded in accordance with the GSM standard. The second bit stream with the voice data and signalization data, which are channel encoded in accordance with the UMTS standard, is received by the fourth send-receive antenna **85** and is supplied to the second channel decoder **95** by means of the fourth send-receive unit **90**. The second channel decoder **95** executes a channel decoding of the voice data and the signalization data of the second bit stream in accordance with the UMTS standard. The evaluation unit **100** detect the channel decoded signalization data which do in face contain known information regarding the type of source encoding of the received voice data of the second bit stream. In the current example, the evaluation unit **100** extracts from the channel decoded signalization data of the second bit stream the fact that the voice data of the second bit stream are source encoded in accordance with the GSM standard. The evaluation unit **100** therefore triggers the switch **105** in such a way that the second channel decoder **95** is connected to the first source decoder **30**, which is embodied as a voice decoder in accordance with the GSM standard. For the case in which the evaluation unit **100** extracts from the received and channel decoded signalization data of the second bit stream the fact that the voice data of the second bit stream are source encoded in accordance with the UMTS standard, it triggers the switch **105** in such a way that it forms a connection—as depicted with dashed lines in the FIGURE—between the second channel decoder **95** and the second source decoder **110**, which is then embodied as a voice decoder in accordance with the UMTS standard. According to the exemplary embodiment described, since the voice data of the second bit stream are source encoded in accordance with the GSM standard, the second channel decoder **95** is connected to the first voice decoder **30** and the voice data channel decoded in the second channel decoder **95** are source decoded in the first voice decoder **30**. The channel decoded and source decoded voice signals present at the output of the first voice decoder **30** and the second voice decoder **110** are then supplied for further processing to additional function blocks not shown in the FIGURE.

The signalization data can also be transmitted from the intermediary station **15** to the second mobile station **5** singly or multiply via a separate control channel separate from the useful data and in turn can include the telephone number of the first mobile station **1** making the call, by means of which the evaluation unit **100** can likewise be induced to connect the first voice decoder **30** to the second channel decoder **95**.

In lieu of or in addition to the voice data, at least video data and/or audio data and/or text data can also be transmitted as useful data from the first mobile station **1** to the second mobile station **5** in the manner described above and combined into one bit stream. The transmission in the first telecommunication network **10** and in the second telecommunication network **20** can take place, for example, in a frequency multiplexed or time multiplexed manner, wherein different multiplexing methods can be used for the two different telecommunication networks **10**, **20**. In this instance, for example, a conversion from time multiplexing to frequency multiplexing or vice versa would also have to be achieve in the intermediary station **15**. Arbitrary other multiplexing or channel access methods can also be used.

With the method according to the invention, it is consequently possible, for example, to transmit useful data that are source encoded according to the GSM standard via a data connection according to the UMTS standard. In this manner, a request for the UMTS standard as the mobile radio standard of the third generation can be fulfilled to assure a backwards compatibility to the existing GSM standard as the mobile radio standard of the second generation in order to exchange useful data between GSM standard mobile stations and UMTS standard mobile stations via a mobile radio connection. The method according to the invention simplifies the transmission of useful data between mobile stations embodied in accordance with the GSM standard and those mobile stations that are embodied in accordance with both the GSM standard and the UMTS standard, wherein the UMTS air interface is used for the part of the data transmission from the corresponding telecommunication network to the mobile station that is embodied in accordance with both the GSM standard and the UMTS standard. As a result, the useful data in the mobile station that is embodied in accordance with both the GSM standard and the UMTS standard are of a quality that has not been reduced by a transcoding between a GSM standard source code and a UMTS standard source code.

The first telecommunication network **10** and the second telecommunication network **20** can each be embodied as a hybrid GSM/UMTS network which combines the functions of a GSM network and a UMTS network. The first telecommunication network **10** and the second telecommunication network **20** can also be identical.

The provision can also be made that the useful data from the first telecommunication network **10** can be transmitted via one or a number of arbitrary fixed networks and possibly via corresponding intermediary stations, to the second telecommunication network **20** and from there, on to the second mobile station **5**, wherein a transcoding with regard to the source code of the useful data, i.e. a source decoding and new source encoding in the corresponding intermediary stations does not occur, but only a channel decoding and possibly, a new channel encoding.

For example, the standard IS95 provided in North America (Interim Standard 95), the PDC standard provided in Japan (Personal Digital Cellular), or the like can also be selected as the first mobile radio standard.

What is claimed is:

1. A method for transmitting useful data from a first mobile station **(1)** to a second mobile station **(5)**, in which for transmission in a first telecommunication network **(10)**, the first mobile station **(1)** source encodes useful data in a first step and then channel encodes the useful data in a second step; the useful data encoded in the first and second steps are transmitted in the form of a first bit stream to an intermediary station **(15)** via a transmission channel of the first telecommunication network **(10)**; the useful data channel encoded in the second step presented in the first bit stream are channel decoded by the intermediary station **(15)**; for transmission in a second telecommunication network **(20)**, the useful data are channel encoded by the intermediary station **(15)** and the useful data thus channel encoded are transmitted to a second mobile station **(5)** via a transmission channel of the second telecommunication network **(20)**, signalization data are transmitted from the intermediary station **(15)** to the second mobile station **(5)**, said signalization data containing information regarding the type of encoding of the useful data in the first step, the useful data channel encoded in the intermediary station are channel decoded by the second mobile station **(5)**, and then the useful data channel decoded by the second mobile station **(5)** are source decoded by the second mobile station **(5)**, according to the signalization data received by the second mobile station **(5)**.

2. The method according to claim **1**, wherein the useful data encoded in the first and second steps are transmitted in the form of said first bit stream to said intermediary station **(15)** via at least one third telecommunication network.

3. The method according to claim **1**, wherein the signalization data are added to the useful data channel decoded in the intermediary station **(15)** so that a second bit stream is produced for the transmission in said second telecommunication network **(20)**, the useful data and the signalization

data of the second bit stream are channel encoded by the intermediary station (15); the useful data and the signalization data of the second bit stream are transmitted to the second mobile station (5) via transmission channel of the second telecommunication network (20); the useful data and the signalization data of the second bit stream are channel decoded by the second mobile station (5) and then the useful data, which are channel decoded in the second step by the second mobile station (5), are source decoded by the second mobile station (5) according to the signalization data decoded by the second mobile station (5).

4. The method according to claim 1, wherein the useful data in the first telecommunication network (10) are transmitted in accordance with a first mobile radio standard; the useful data are source encoded and channel encoded in the first and second step respectively, the useful data in the second telecommunication network are channel encoded and are transmitted in accordance with a second mobile radio standard together with the signalization data, said signalization data include said information regarding the type of encoding of the useful data in the first step in accordance with the first mobile radio standard; and wherein the useful data coded in the second step, which are decoded by the second mobile station (5), are decoded by the second mobile station (5) in accordance with the first mobile radio standard after evaluating the signalization data.

5. The method according to claim 4, wherein said first mobile radio standard is a global system for mobile communications and said second mobile radio standard is universal mobile telecommunications system.

6. The method according to claim 4, wherein the useful data in the first mobile station (1) are source encoded by a voice encoder (25) according to GSM standard ITU-T G.729 and wherein the useful data in the second mobile station (5) are source decoded by a voice decoder (30) in accordance with the first mobile radio standard.

7. A method for transmitting useful data from a first mobile station (1) to a second mobile station (5), in which for transmission in a first telecommunication network (10), the first mobile station (1) encodes useful data in a first step and then encodes the useful data in a second step; the useful data encoded in the first and second steps are transmitted in the form of a first bit stream to an intermediary station (15) via a transmission channel of the first telecommunication network (10); the useful data encoded in the second step presented in the first bit stream are decoded by the intermediary station (15); for transmission in a second telecommunication network (20), the useful data are channel encoded by the intermediary station (15) and then are transmitted to a second mobile station (5) via a transmission channel of the second telecommunication network (20); signalization data are transmitted from the intermediary station (15) to the second mobile station (5), said signalization data containing information regarding the type of encoding of the useful data in the first step, the useful data encoded in the intermediary station are decoded by the second mobile station (5) and then the useful data coded in the first step are decoded by the second mobile station (5), according to the signalization data received by the second mobile station (5).

8. The method according to claim 7, wherein the useful data encoded in the first and second steps are transmitted in the form of said first bit stream to said intermediary station (15) via at least one third telecommunication network.

9. The method according to claim 7, wherein the signalization data are added to the useful data coded in the second step and decoded in the intermediary station (15) so that a second bit stream is produced for transmission in said second telecommunication network (20), the useful data and the signalization data of the second bit stream are encoded by the intermediary station (15), the useful data and the signalization data of the second bit stream are transmitted to the second mobile station (5) via a transmission channel of the second telecommunication network (20), the useful data coded in the second step and the signalization data of the second bit stream are decoded by the second mobile station (5), and the useful data coded in the first step, which are decoded in the second step by the second mobile station (5), are decoded by the second mobile station (5) according to the signalization data decoded by the second mobile station (5).

10. The method according to claim 7, wherein the useful data in the first telecommunication network (10) are transmitted in accordance with a first mobile standard; the useful data are source encoded and channel encoded in the first and second step, the useful data coded in the second telecommunication network are channel encoded and are transmitted in accordance with a second mobile radio standard together with the signalization data, said signalization data include said information regarding the type of encoding of the useful data in the first step in accordance with the first mobile radio standard; and wherein the useful data coded in the second step, which are decoded by the second mobile station (5), are decoded by the second mobile station (5) in accordance with the first mobile radio standard after evaluating the signalization data.

11. The method according to claim 10, wherein said first mobile radio standard is global system for mobile communications and said second mobile radio standard is universal mobile telecommunications system.

12. The method according to claim 10, wherein the useful data in the first mobile station (1) are source encoded by a voice encoder (25) according to GSM standard ITU-T G.729 and wherein the useful data in the second mobile station (5) are source decoded by a voice decoder (30) in accordance with the first mobile radio standard.

13. The method according to claim 1 or 7, wherein the signalization data are transmitted from said intermediary station (15) to said second mobile station (5) singly or multiply via a separate control channel.

14. The method according to claim 1, 3, 7 or 9, further comprising transmitting a telephone number of the first mobile station (1) along with said signalization data containing said information regarding said type of encoding of the useful data in the first step.

15. The method according to claim 1 or 7, wherein said useful data comprises at least one of video data, audio dat, text data and voice data.

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